COAL AGE

OCTOBER, 1961 A McGRAW-HILL PUBLICATION PRICE $1

Golden Anniversary Issue

The Challenge Of Coal's New Growth Era

1861

1961

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salutes its many friends and customers

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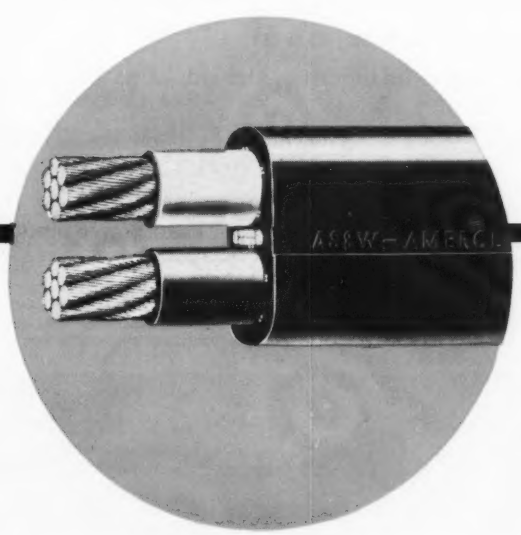

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This Month in COAL AGE

October, 1961

GOLDEN ANNIVERSARY ISSUE

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Foreword: The Coal Future—and Its Challenge . . . . . p 109

A Program for Coal . . . . . p 110

Directed to the achievement of maximum sales in the coming growth era for coal, this program embodies nineteen suggestions for action in the fields of management, production, sales, service and related activities. Based on their own studies as well as the thinking of the industry, this program is the editor's compilation of practical pointers for building business.

The U. S. Economy . . . . . p 118

Prepared by the McGraw-Hill Dept. of Economics especially for this Golden Anniversary Issue of *Coal Age*, this feature traces the economic growth of the U. S. over the past 50 yr and forecasts what could happen in the period ahead to the year 2000. The picture is one of major growth all along the line—population, industrial output, gross national product, etc., etc.

A Half Century in Coal—and the Next 10 Years . . . . . p 124

What has happened in the anthracite and bituminous industries since 1910 in production, competition, number of mines and companies, number of men, equipment, productivity and profitability—and what can happen in the next 10 yr. Among the conclusions: a major increase in bituminous output and stable mine prices.

People . . . Industry . . . Fuels . . . p 132

Where the people are and how many, where industry is concentrated, and where the various fuels find their markets today—also the picture in all three respects in 1970. Growth in people, industry and fuel use is the story of the future, with, as in the past, the heavy concentration east of the Mississippi and particularly in the states around the Great Lakes east to and including New York and Pennsylvania. Regional analysis of growth in population, industry and fuel use is featured.

The Competitive Challenge . . . . . p 138

Why bituminous coal use should rise to 625 to 650 million tons in or near 1970. Big reasons are the further inescapable rises in the prices of oil and gas, while coal prices will remain the same and coal freights will drop. In fact, in certain areas right now, gas and gasoline from coal would be competitive, and this will be a significant new market by 1970, with of course continued growth thereafter. And coal will make major gains in present markets. The prescription for meeting the challenges of competitors is set forth.

Merchandising—Key to Maximum Sales Growth . . . . . p 146

How coal has improved its merchandising setup and strengthened its merchandising power, plus concrete suggestions for building a merchandising program that will result in the maximum business possible to obtain in the future. What must coal do to cash in on its growing cost and quality advantages?

Public Relations for Coal Progress . . p 152

What underlies the gains coal has made in public opinion and legislative and administrative respect—and what individuals, coal corporations and industry organizations can do jointly and severally to build even greater goodwill in the future.

(*Continued on p 7*)

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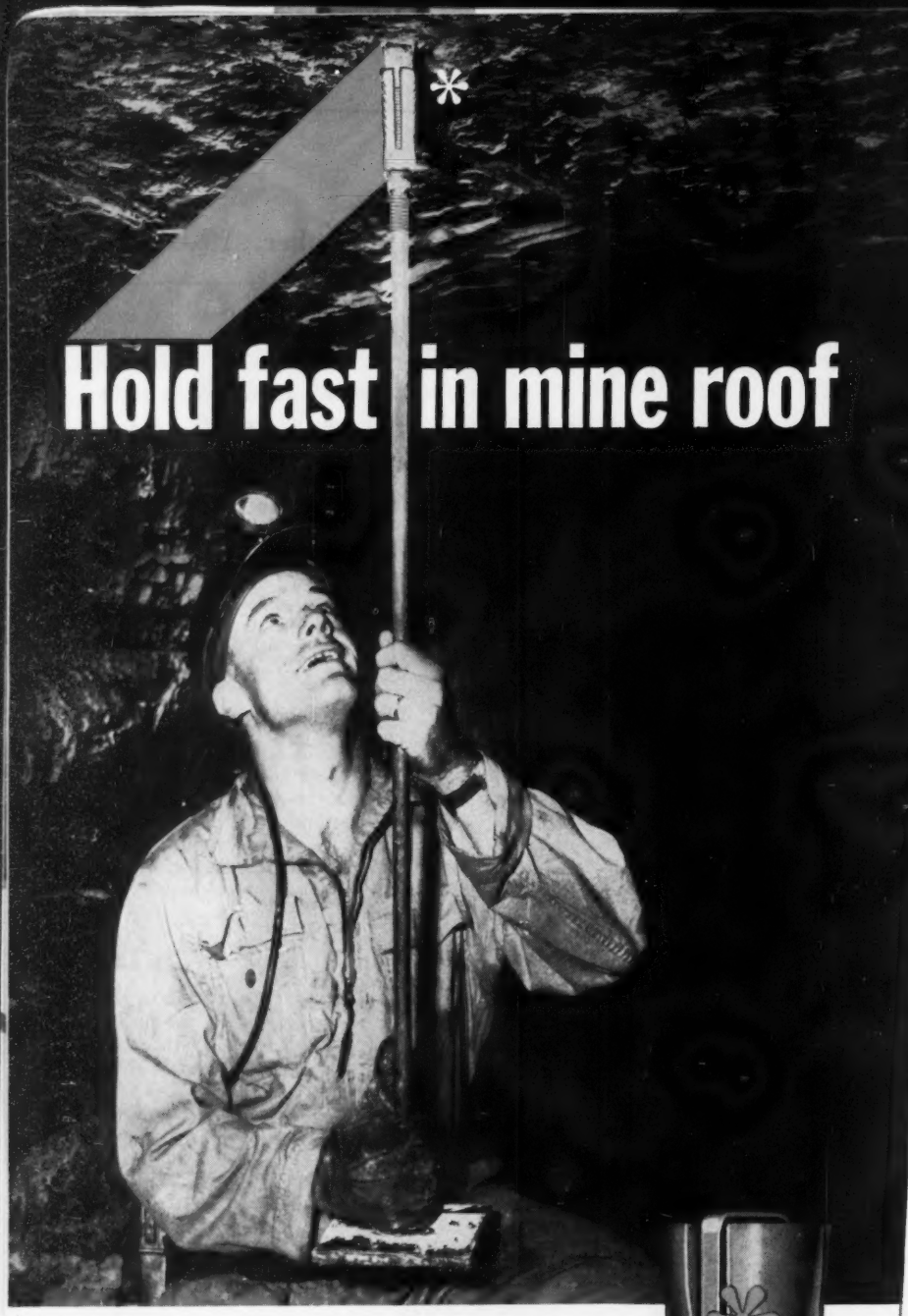
Hold fast in mine roof



To:
Mr. Charles Maynard
Mine #3

Chuck:

This is the shell I talked to you about last week at the mine. Roof bolting is right up O-B's alley... they pioneered the use of expansion units... probably know more about them than anyone in the field. I suggest you get in touch with their local sales engineer. I've found Ohio Brass people are glad to work right with you in the mine.

Regards,
Jack

Ohio Brass 4-Way Expanding Anchors hold in both soft shale and hard rock

- **GO UP FAST** . . . 4-way expansion begins with the first turn of the wrench.
- **DEVELOP TOP HOLDING POWER** with easy wrenching effort . . . 150 "foot pounds" of torque gives bolt tensions of 9000 pounds.
- **WORK IN CLOSE QUARTERS** . . . O-B engineers developed these anchors underground. Personal knowledge of mining problems enabled them to design units that are especially suited to your needs.
- **GET SERVICE** for your roof bolting problems . . . see your local Ohio Brass engineering representative or write Ohio Brass Company, Mansfield, Ohio.

O-B Bail Type Expansion Shell and Plug

Ohio Brass (B) HOLAN

EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS

How the United Mine Workers See It p 154

What the union views are on coal problems and progress as summarized by President Thomas Kennedy. Joining with those who expect a new period of growth, the union foresees the need for greater research and sales effort, along with gains on the production, preparation and sales fronts.

Deep Mining—Past Developments and Future Gains . . . . . p 156

Stressing key developments in a look at the history of face operations and supporting services, this 24-p section forecasts further major gains in tons per man underground through the development of improved mining units and methods, with remotely controlled robot machines as the producers of the future—more than likely on longwall faces.

A Half Century in Stripping—and the Next 10 Years . . . . . p 180

From practically zero in 1910 to over 30% of the tonnage now, stripping will continue as a major production method in the future—possibly accounting for one-third of the bituminous output in 1970. The super excavators of tomorrow may be challenged by new units that can do their own digging.

Building Coal Quality Through the Years . . . . . p 188

How coal went about working up to its present level of mechanical cleaning, screening, dewatering, drying, water clarification and handling, and automatic control of separating efficiency and other operations—and what's ahead in the preparation field to 1970.

Manpower for Coal's New Growth Era p 196

How many men will be needed to produce the larger bituminous tonnage of the future, what qualifications they must have, and what training they will need. Also, what the manager and supervisor of tomorrow will be responsible for in production and other functions, what he will need to know, and how he can acquire the necessary knowledge and skill.

The Safety Movement . . . . . p 200

A look at the origins of the safety movement in the coal mines of the U. S. and its development over the years lead to an analysis of what may be expected in the future toward attainment of as near the irreducible minimum in injuries and fatalities as possible. The 1970 fatality rate? It should be no more than 0.14 per million.

Coal Age and Coal . . . . . p 211

How *Coal Age* came about, and how it has gone about rendering the best-possible production, marketing, news and related services to its subscribers in its 50-yr history, supplemented by a discussion of the role played by the

(*Continued on p 9*)

This Month in COAL

9,000,000 AHEAD?—Some strengthening of the production rate in September made it easier to feel that the weekly bituminous output can get up to 9 million tons or more for at least part of the time in the last 3 mo of 1961. One reason for being optimistic is the growth in steel output which, though modest, is beginning to have some effect. But most of the record has been made, and even though the rate in the last quarter improves, bituminous will end 1961 significantly under 1960. However, the improvement should mean a better 1962.

Warm weather in September got anthracite off to a slow start on the 1961-62 heating season, but a return to last winter's temperatures—if that should occur—still would make it a good year.

THE PROFIT PICTURE—Low demand and in turn low production always have their effect on prices. With some rare exceptions the published financial statements so far in 1961 show lower earnings, reflecting both reduced production as well as price pressure not fully offset by additional cost reductions through increased efficiency. At the moment, though it can be expected that there will be another substantial rise in tons per man, the average value per ton will not be over $4.60 in 1961, compared to $4.69 in 1960.

PIPELINE PRESSURE—Though the Pennsylvania legislature tried to set up a roadblock in that commonwealth, and though coal men are doing little or no talking, the interest in coal pipelines has increased materially in 1961—outside the industry as well as in. Oil and gas pipeline companies, railroads, utilities, investment houses, financial services and others are digging into the question. But though rumors of lines are many, with locations from the Pacific Coast to the Atlantic and Gulf, nothing concrete in the line of proposals is yet out in the open. But the betting is that there will be soon.

COAL THE LEADER—Fuel injection into blast furnaces is suddenly a hot subject, even though actual installations so far are experimental. Oil, gas and coal are faced off in the battle, which will be decided eventually on the basis of cents per million Btu. The prospects for its winning out were enhanced recently when a major corporation bought the BCR rights and know-how in coal injection. It can be concluded that whatever the form coal will remain the premier blast-furnace fuel with minor exceptions.

CONGRESSIONAL SCOREBOARD—On balance, coal seems to be somewhat ahead in Congressional action. The Hanford nuclear-power-plant battle was won, for now, when it seemed it was lost, and Congress moved to give coal a good part of what it had been seeking in advocating of a study of the desirability of a "National Fuels Policy." Nothing was gained on the tax front, and perhaps much need not have been expected. Coal also was not involved in some of the actions aimed at limiting business freedom, though the pressure for such limitation increased—and may later involve coal as well as other business to a greater degree.

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Specifically manufactured for use with ammonium nitrates, Austin ACP Primers are insensitive to shock and abrasion . . . are unaffected by water. Also, Yellow Cap, Green Cap and Red Cap each possess rifle impact sensitivity of zero. If loaded in a hole that fails to detonate, they may be more safely removed than conventional primers.

Lightweight ACP Primers are also easier to use than regular dynamite types. Smaller than a man's fist and furnished with a central channel, they permit quick threading of detonating fuse through their entire length. In deep holes, additional primers can be rapidly added on the cord at desired intervals.

ACP Primers are offered in 6 color coded sizes. In addition to central fuse channel, Austin Brown Cap, Black Cap and Orange Cap each contain a well for inserting electric blasting cap when base detonation of a column of explosives is desired. Red Cap also is offered optionally with a 1 ft. length of detonating fuse for use where primer is placed inside a pre-packaged blasting agent. The fuse, which extends from the top of the primer charge, can be tied or hooked to the down line of detonating fuse in the hole.

AUSTIN ACP PRIMERS

Color Coding	Fuse Channel	Cap Well	Weight	Size	Number per box
Yellow	√		6 oz.	2" x 2"	100
Green	√		8 oz.	2" x 3"	100
Brown	√	√	8 oz.	1¾" x 3¾"	100
Red	√		12 oz.	3" x 2"	50
Black	√	√	12 oz.	2" x 4¼"	50
Orange	√	√	1 lb.	2¼" x 4⅛"	50

A-5337A

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technical and business press in general and how it achieved its present high standards. The positive and dynamic approach of *Coal Age* has ranged all the way from the problem of drunks in boarding houses to programs for overall industry stabilization, including such things as the only awards available to miners in World War II for excellence in supporting the war effort.

For Help Received

Though the pages of the publication itself has been the source of the majority of the material in this issue, it could not have been prepared without drawing on outside sources. The U. S. Bureau of Mines of course provided most of the statistics and are due extra thanks for special service in this respect. So many men in coal and manufacturing circles provided specific items of information that it is impossible to list them all. But they and all others who contributed to this issue can be sure of the grateful appreciation of the editors.

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THIS MONTH . . . in Mining Practice

UP AGAIN—Bituminous tons per man rose again in 1960 to 12.83, compared to 12.22 in 1959. In anthracite, the figures were 5.60 for 1960 and 5.12 for 1959. These increases were well in the line with the general trend since 1950, which was the year, as shown elsewhere in this issue, that the curves in both industries turned sharply upward. Another substantial increase—13.5 tons or more in bituminous and 6.00 or better in anthracite—can be expected in 1961. More will follow in subsequent years since the possibilities are a long way from being exhausted.

POSITIVE SUPPORT—Longwall without packwalls always, until recently, failed in the U. S. because the roof could not be controlled. Now, with new types of movable steel supports developed abroad, plus, to date, techniques and equipment also developed abroad it appears that a face can be kept open and the top behind it can be broken and caved with complete assurance that neither the supports nor the face will be lost. In other words, the support is positive and can be depended upon. Also, the capital cost is not too great. It may well be that longwalling will become as familiar to U.S. producers as room-and-pillar.

WITHOUT SHOOTING—The wheel and the ripper, with assists from other types of equipment, are already doing a job similar to that of the continuous miner underground—digging overburden and coal without drilling and shooting. Their use will continue to expand, but will it ever be possible to eliminate drilling and shooting in hard rock? So far the betting is the other way, but metallurgy and horsepower are the keys. The latter we have. Bits, however, and the gears and shafts to back them up, still have a way to go. But miners cut rock underground—though not on a production basis—and the job is basically the same in a strip pit. More work on the idea is definitely in the cards.

GAS MONITORING—As long as the only way gas can escape from coal is into the mine openings, the need for a better method of detecting its presence and its percentage will continue to be critical. The instruments themselves are no minor items, but other questions are not easy either. Where should the detector heads be? Should detection be the only function or should the instrument automatically cut off power? If the latter, only the section or over the entire mine? And so on. It may be simpler in the end, in addition to being more desirable—to try to bleed the gas—or a big part of it—off ahead of mining by boreholes, infusion and other steps.

FOUR KEYS—Though resistance to wear and breakdown can be built into equipment—at an increase in price—maintenance will always be necessary, though it may not be as big an item as it is now. The idea of spending to get breakdown resistance is receiving increased attention and undoubtedly will become the standard approach. Meantime, the four keys to low downtime and repair costs remain (1) systematic inspection, (2) accurate records, (3) schedule maintenance of each unit, and (4) running records of operating time unit by unit.

Conventional hydraulic fluid burns fiercely when sprayed into flame.

Shell 3XF hydraulic fluid does not burn in identical test. It's safe.

PHOTOS COURTESY U.S. BUREAU OF MINES

BULLETIN:

Shell Research forces water into oil to produce an economical, fire-resistant hydraulic fluid for mines

Hydraulic mine machinery is run by electricity. A short circuit can start a fire. The flames can melt a hydraulic hose and feed on a conventional fluid.

New Shell 3XF® Mine Fluid, mixed with water, reduces this risk. It is an economical, water-in-oil emulsion that resists fire.

Read how this product of Shell Research became the first fire-resistant hydraulic fluid to be approved by the U.S. Bureau of Mines under Schedule 30.

WITH THE invention of Shell 3XF Mine Fluid, the danger of underground mine fires can be greatly reduced.

Here is the story of how Shell scientists developed this remarkable product:

Mineral oil, they knew, is an excellent hydraulic fluid. But it burns. Water is an excellent fire extinguisher, but not the best lubricant.

Why not find a way to combine the two? Oil for lubrication, water for safety. No simple task. But Shell Research did it.

They did it by perfecting a unique kind of water-in-oil emulsion. The water was literally forced into the oil—making a stable, emulsion-type hydraulic fluid. The oil lubricates. The water provides all-important protection against fire.

How it was proved

Exhaustive tests of 3XF hydraulic fluid proved its effectiveness – under fire. One of those tests is pictured above.

Even when sprayed into a flame, 3XF hydraulic fluid would not create a fire hazard.

However, safety alone was not enough. 3XF hydraulic fluid also had to work in existing mining machinery. And it would be most desirable if it could be compounded *at the mine.*

Add water and use

So, Shell Research developed a special concentrate called *3XF Mine Fluid.* Add 40% drinking water to 60% concentrate—mix, and the product is ready for use.

Mines evaluated the performance of Shell fluid in hydraulically operated equipment. Twenty-five decided to use it.

On February 18, 1960, Shell 3XF Mine Fluid ushered in a new era of mine safety when it became the first fluid approved under U.S. Bureau of Mines Schedule 30.

For complete data about 3XF Mine Fluid, contact your Shell Industrial Products Representative. Or write: Shell Oil Company, 50 West 50th St., New York 20, N.Y.

SHELL

A BULLETIN FROM SHELL
—where 1,997 scientists are working to provide better products for industry.

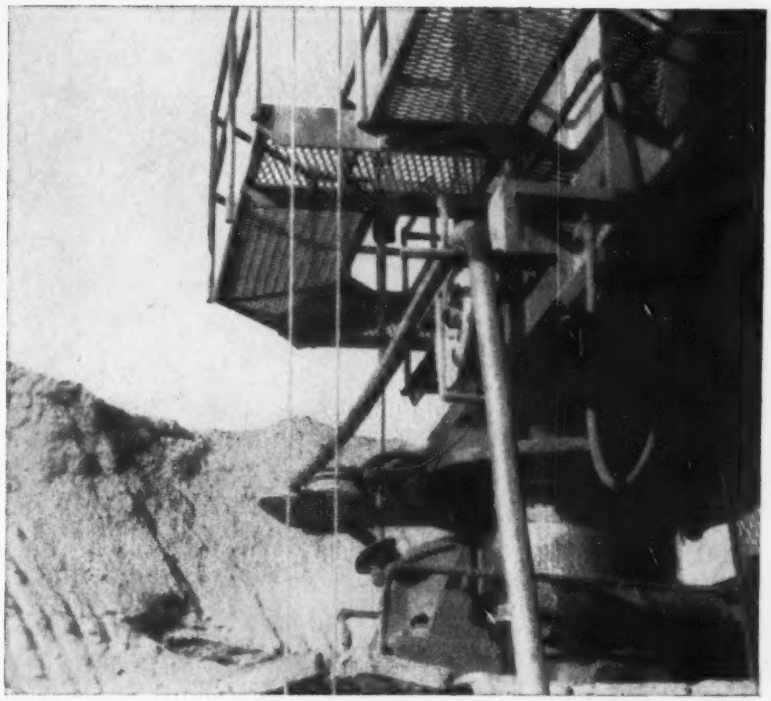
The Importance of Balanced Compounding in Portable Cable Design

A portable cable is constantly under attack from many different directions. It is dragged over rough floor surfaces and rocky terrain, crushed under the wheels of trucks and carts, continually bent, flexed and stretched. In addition, it is very often subjected to attack by water, solvents, oil and ozone.

To give long, dependable service, portable cables must be able to withstand rough treatment, and must have built-in protection against all deteriorating factors. Moreover, they must possess other desirable qualities such as lightness and flexibility.

The science in designing these cables is to add the necessary ingredients in the jacket to provide maximum protection along with the maximum of other desirable features. This is where *Balanced Compounding* comes in. It is very easy to provide protection against one or two of the deteriorating factors, simply by loading the compound with an ingredient which is impervious or highly resistant to these factors. Unfortunately, however, the ingredients which provide resistance to abrasion or crushing may be highly susceptible to attack by oil or water; and vice versa.

The cable designer's problem, then, is to attain a balance in his compounding formula which will provide maximum protection against one deteriorating factor without reducing protection against others below the danger point.



To the buyer of cables, this means that *quantity* of any one ingredient is unimportant, unless it is considered in relation to the over-all ability of the cable jacket to resist *all* of the abuses to which it is subjected.

For balanced resistance to all these abuses, the best assurance you can get lies in the quality of the research and development facilities of the manufacturer, and the product's record of performance.

This is one reason why — in those industries where portable cables are continually used or purchased as components of a manufactured product — Simplex Tirex Cables are regarded as the standard.

Proof of the worth of Tirex *Balanced Compounding*, which gives balanced resistance to all the deteriorating factors of normal use, can be found in the fact that Tirex cables have been successfully performing under the most rugged operating conditions for periods ranging up to twenty years.

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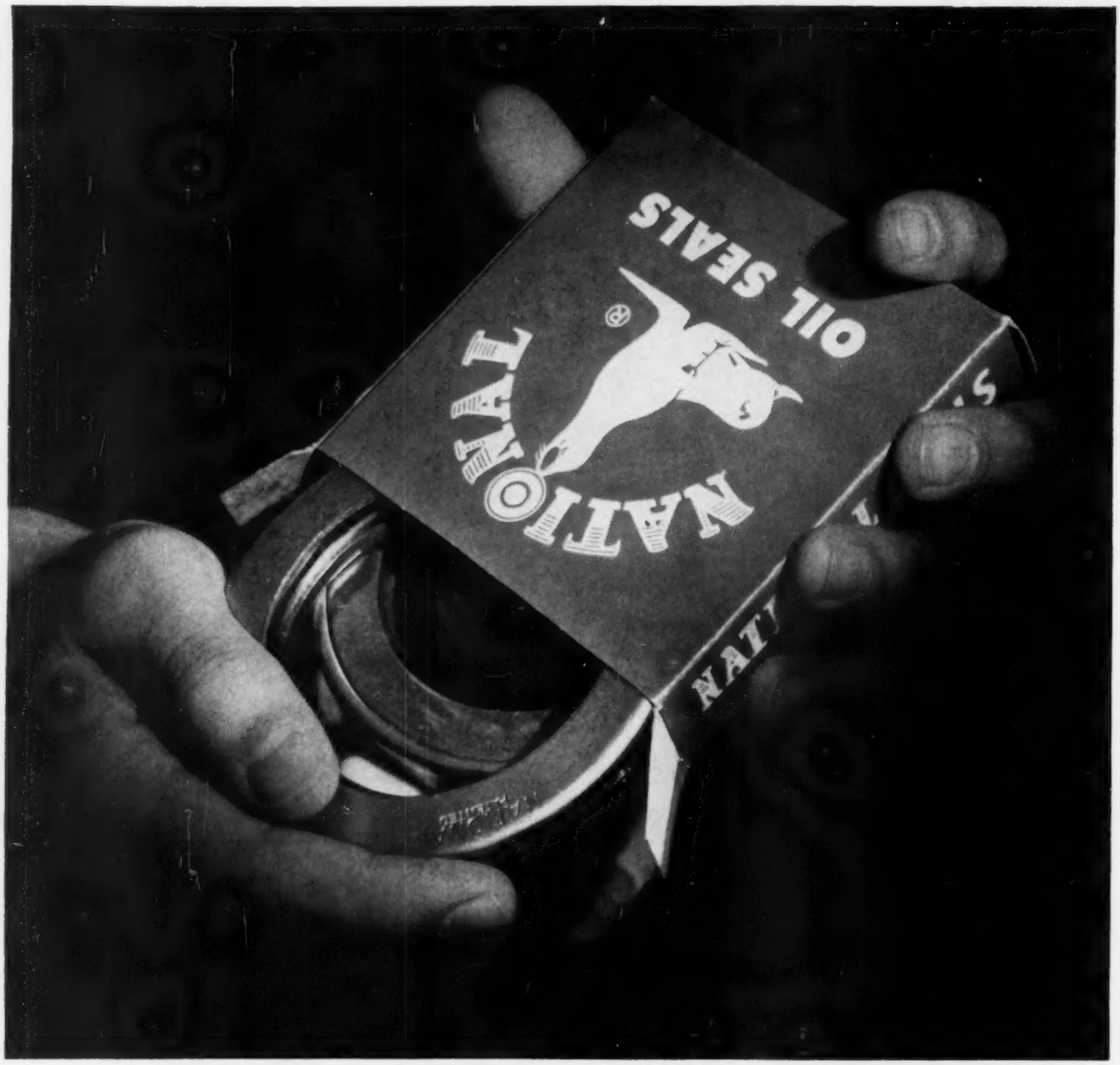

This is no surprise package

When you open a box of National Oil Seals, you know exactly what to expect . . . a quality product. Micro-Torc® leather and Syntech rubber seals are results of the finest engineering, design and testing techniques. They protect bearings better and longer.

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Coal, Overburden or Refuse...

"EUCS" CUT HAULING COSTS

Euclid Rear-Dump and Bottom-Dump Haulers, Scrapers and Crawler Tractors have earned their reputation for more work-ability on scores of open pit operations. Built expressly for off-highway service, they have the speed, capacity and stamina to move more material per shift . . . with minimum downtime and maintenance expense.

The 51-ton Bottom-Dump and Euclid Rear-Dumps with capacities from 10 to 55 tons are top performers on hauling operations. The Bottom-Dump "Euc" is powered by a 380 h. p. engine and has a standard transmission with 9 forward speeds. Rear-Dump models have engines of 132 to 672 h. p. and Torqmatic or standard transmissions.

For overburden removal, building and maintaining haul roads, stockpiling and other open pit jobs, "Euc" Scrapers and Tractors cut costs, too. Three types of self-powered scrapers have struck capacities of 7 to 24 cu. yds. There are two tractor models—the 211 net h. p. C-6 and the big twin-power TC-12 with 425 total net h. p. Both have Torqmatic Drive that provides full-power shift and easy operation.

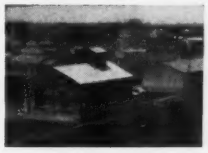
Check the complete "Euc" line for the advantages that apply to your operation . . . a Euclid dealer can show you facts and figures proof that ***Euclids are your best investment.***

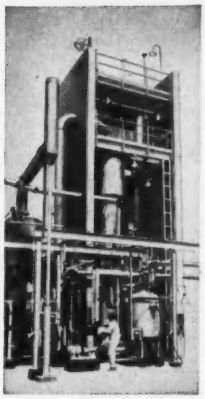
EUCLID Division of General Motors, Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

EUCLID

FOR MOVING EARTH, ROCK, COAL AND ORE





OUR OLD NAME originally referred to explosives when we were incorporated back in 1912. Making explosives was a relatively simple process, once you mastered the fine art of making nitroglycerin.

OUR NEW NAME comes from our expansion in the broad chemical field —polyols, emulsifiers, pharmaceuticals, activated carbon, and nitrogen chemicals. Users of explosives will benefit directly from the nitrogen expansion because it makes Atlas basic in ammonium nitrate. Near the Joplin, Missouri, plant of Atlas, the Solar Nitrogen Chemicals, Incorporated, owned equally by Atlas and the Standard Oil Company (Ohio), has completed a $15,000,000 facility, making it one of the nation's primary ammonia producers. High explosives production has also been modernized and facilities concentrated in Missouri and Pennsylvania to give users of explosives high quality products and the most complete line in the industry.

All this is a far cry from the secluded powder mill of the old days. And since our growth has been so much involved in chemicals, we have changed "Powder" to "Chemical" and have gathered all our activities together under "Industries". So, from now on, our official name is Atlas Chemical Industries, Inc. But to users of explosives, Atlas will continue to be in the traditional sense "a powder company." You can still call us "Powdermen" because that's what we are. We welcome the chance to prove this in your operation.

ATLAS CHEMICAL INDUSTRIES, INC.
EXPLOSIVES DIVISION
WILMINGTON 99, DELAWARE

Yieldable Arches "give" to stabilize roof

Where conditions underground are unstable, Bethlehem's Yieldable Arch is often the best answer for dependable roof support. Utilizing the old technique of letting the enemy beat himself, the Arch yields gradually instead of steadfastly resisting, so that the overburden can settle into a natural arch of its own.

As long as pressures are excessive, the Yieldable Arch will continue to "give." As soon as stability is reached, the Arch holds the line.

A Yieldable Arch Set consists of curved U-shaped sections nested together and overlapped enough to permit clamping with husky U-bolt clamps. The clamps control the tightness in the joint, and permit yielding when the forces exceed the load for which the joint was intended. Each Arch set is connected to adjoining sets by means of horizontal struts, which add lateral rigidity to the structure.

Besides increasing mine safety, the Yieldable Arch offers high salvageability, and usually pays for itself within its first year of service. A Bethlehem engineer would like to discuss the Yieldable Arch with you. You can reach him through the nearest Bethlehem office.

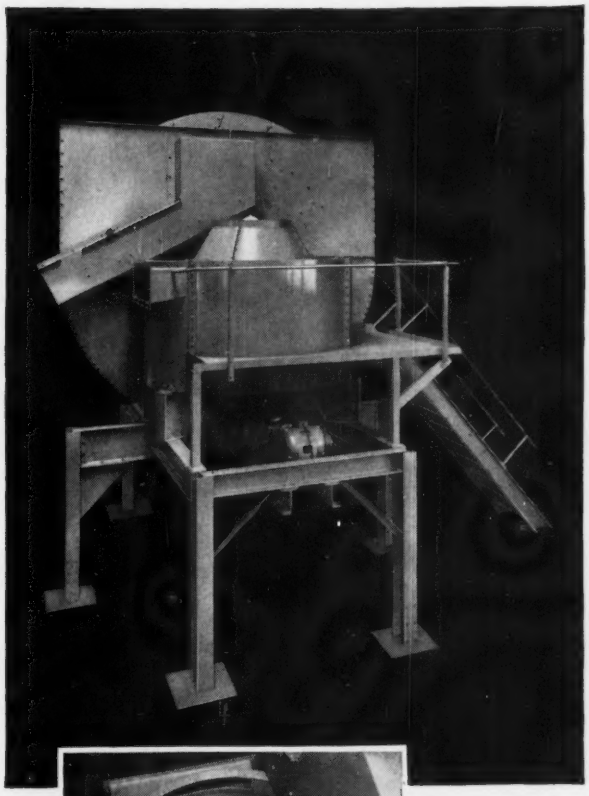
Steel *for Strength . . . Economy . . . Versatility*

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Sales:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Dense Medium Separation— with a Difference

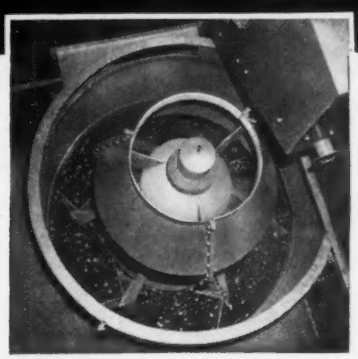


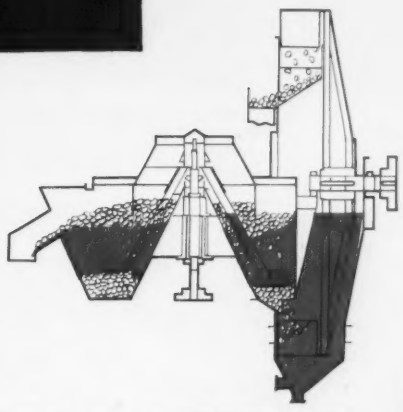
THE **NORTON** DENSE MEDIUM SYSTEM *WITH THE* NORWALT *SEPARATOR*

IT'S ACCURATE—its unequalled efficiency will enable you to get every last cent out of your Raw Coal.

IT'S SIMPLE—its mechanical simplicity ensures greater reliability and lower operating costs.

IT COSTS LESS—with the NORWALT Separator you can handle up to 600 TPM in a single vessel and save in capital costs.





IT GIVES MAXIMUM ECONOMIC RECOVERY AND BOOSTS PROFITS

NORTONS-TIVIDALE LIMITED
307 NORTH MICHIGAN AVENUE · CHICAGO 1, ILLINOIS
PHONE-AREA 312 CHICAGO 332-6052

NORTONS TIVIDALE

NORTONS-TIVIDALE LIMITED
TIPTON, ENGLAND
PHONE-TIPTON 1201

NORTONS-TIVIDALE SOUTH AFRICA (PTY) LTD.
P.O. BOX 1469 JOHANNESBURG SOUTH AFRICA
PHONE-34-3941

☐ Send literature on the NORTON Dense Medium System.
☐ Send literature on the NORTON Jig Washer.

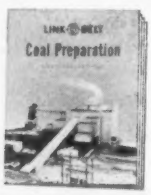
NAME_____
TITLE_____
FIRM_____
ADDRESS_____
CITY_____ STATE_____

LINK-BELT coal

...the most complete line for handling and processing a better product at lower cost

With over 60 years' experience and a complete line of equipment, Link-Belt is in a unique position to fulfill any coal preparation need. We'll design, equip and erect complete facilities. Or, if there is need for modernizing your present installation, Link-Belt can supply individual units, engineered to bring new economy and efficiency to your operation. And when it comes to replacement parts, Link-Belt has them all . . . including a full range of chains, sprockets, speed reducers and other power transmission products.

Contact your nearest Link-Belt office for an obligation-free analysis of your specific requirements. Ask for our 36-page Book 2655, showing Link-Belt equipment for coal preparation. Address: Dept. 1061-CA.



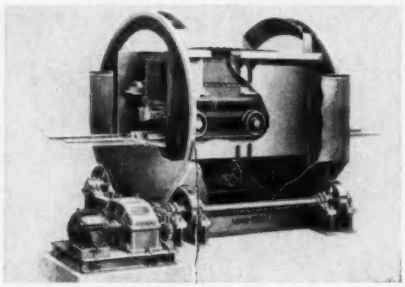
LINK-BELT

COAL PREPARATION AND HANDLING EQUIPMENT

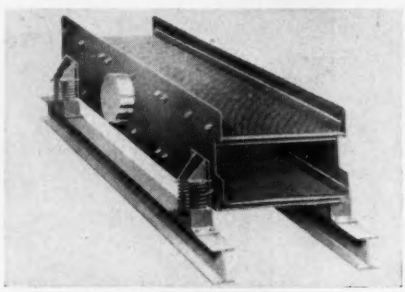
14,007-R

LINK-BELT COMPANY: Dept. 1061-CA, Chicago 9, Birmingham 9, Cleveland 20, Denver 2, Detroit 4, Huntington 9, W. Va., Indianapolis 6, Kansas City 8, Mo., Louisville 8, Pittsburgh 13, Seattle 4, St. Louis 1, Salt Lake City 1. To serve Industry There are Link-Belt Plants, Warehouses and District Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World.

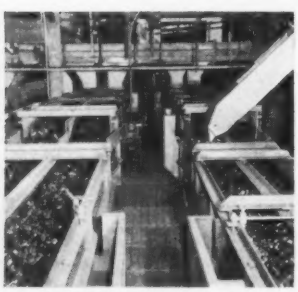
CONVEYING is done quickly with minimum degradation by Link-Belt conveyors. Complete line includes belt, drag, screw, flight and other types.



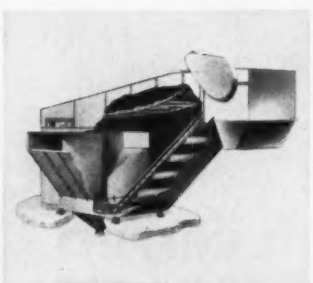
DUMPING is done smoothly by Link-Belt mine car rotary dumpers. Also available: railroad car dumpers, car hauls, car shakers, receiving hoppers.



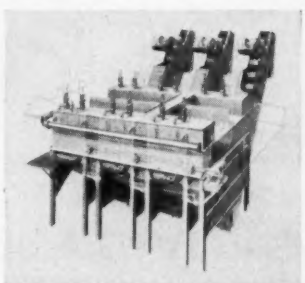
CLASSIFYING. In Link-Belt's broad range of liquid and dry vibrating screens, there are types and sizes to meet every classifying requirement.



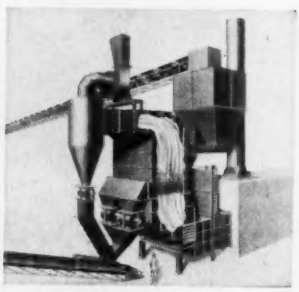
OSCILLATING CONVEYORS. Link-Belt oscillating conveyors distribute sized coal to loading booms uniformly, with minimum degradation.



CLEANING: TANK AND DRUM TYPE CONCENTRATORS use principle of float-sink separation in a magnetite and water mixture.



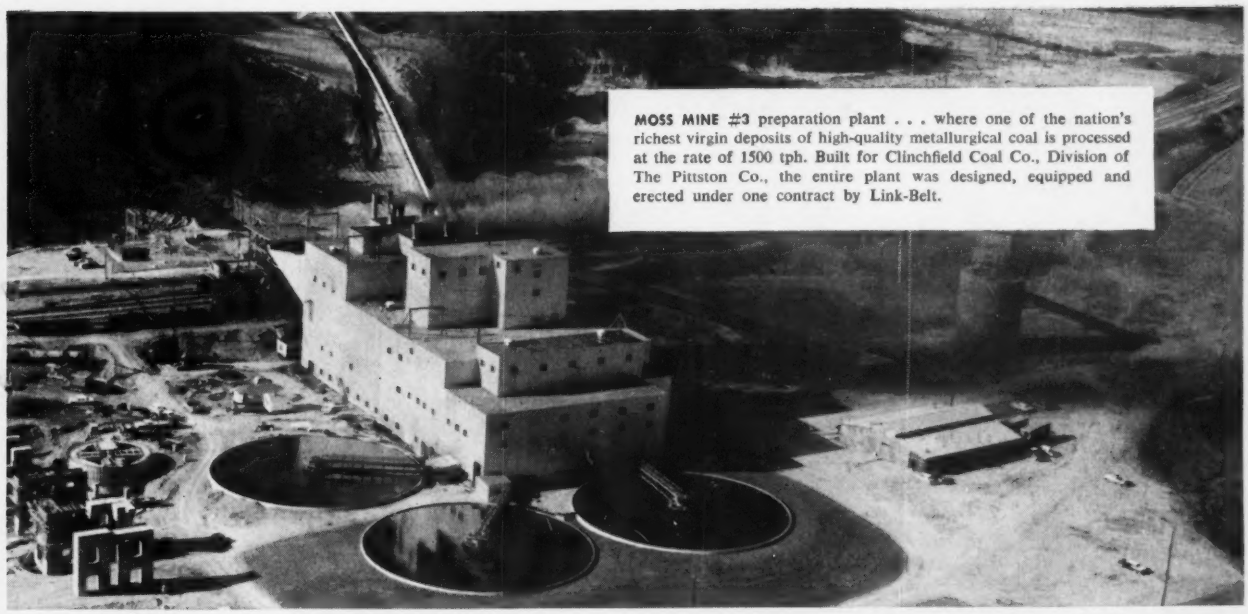
AIR-PULSATED WASH BOXES. Single and double bed types —both with new, automatic refuse discharge control.



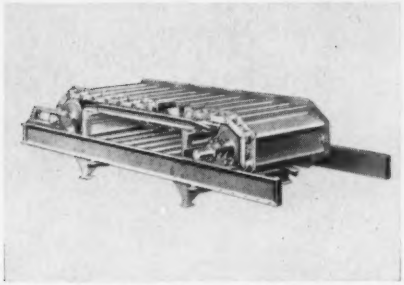
FLUID-FLO DRYERS handle coal in a fluidized state by means of heated air or gases in a continuous flow.

REPLACEMENT PARTS for every need are immediately available from Link-Belt:

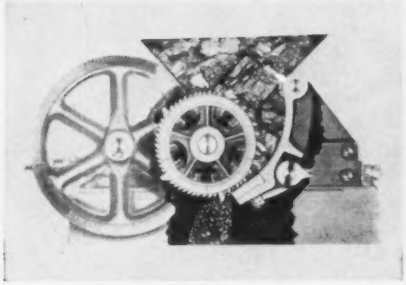
preparation equipment



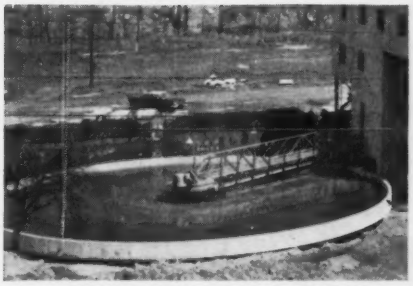
MOSS MINE #3 preparation plant . . . where one of the nation's richest virgin deposits of high-quality metallurgical coal is processed at the rate of 1500 tph. Built for Clinchfield Coal Co., Division of The Pittston Co., the entire plant was designed, equipped and erected under one contract by Link-Belt.



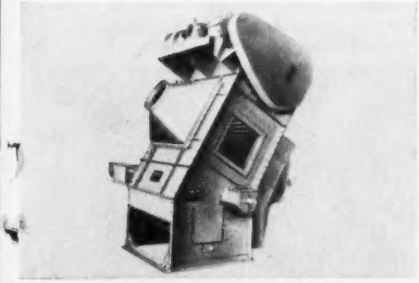
FEEDING. All Link-Belt feeders assure a uniformly controlled feed. Link-Belt offers apron, belt, reciprocating, vibrating and many other types.



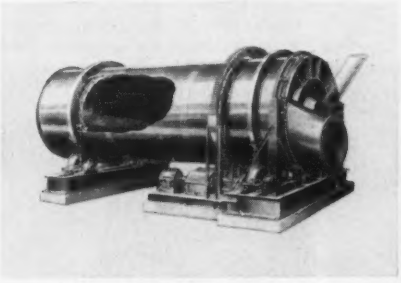
CRUSHING. Link-Belt's three types of crushers—single roll, double roll and adjustable double roll—are made in sizes for every crushing need.



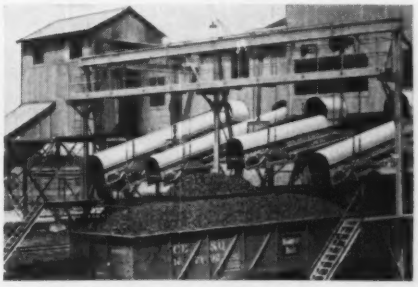
WATER CLARIFICATION. Link-Belt's wide variety of wash water recirculation equipment includes thickeners, drag tanks, settling cones, classifiers.



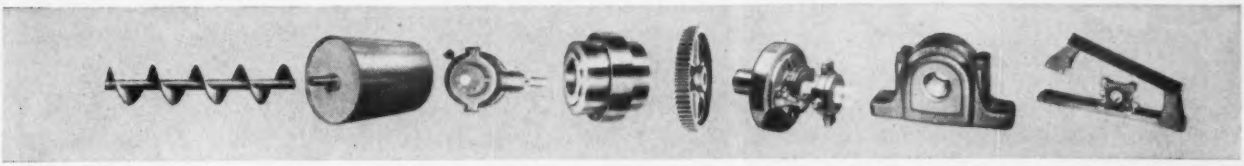
MULTI-LOUVRE DRYERS produce a highly marketable coal at low cost per ton. Gentle action assures minimum degradation.



ROTO-LOUVRE DRYERS are used where precise temperature control is required. Widely used for drying and pelletizing extremely fine coal.



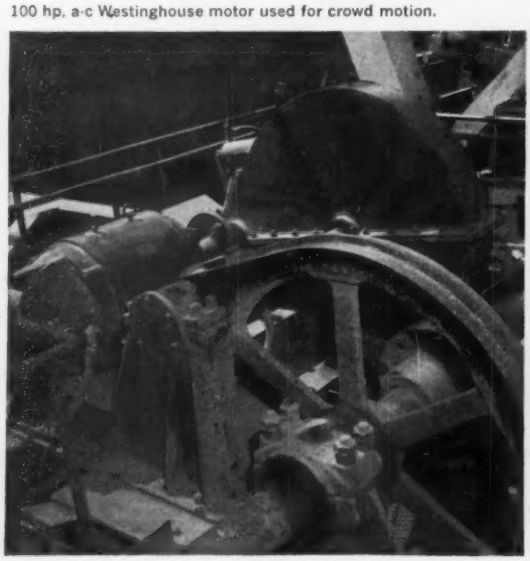
LOADING. Link-Belt has equipment to speed *any* loading operation: loading booms, gates, barge shifters, car spotters and pullers, shovels, draglines.



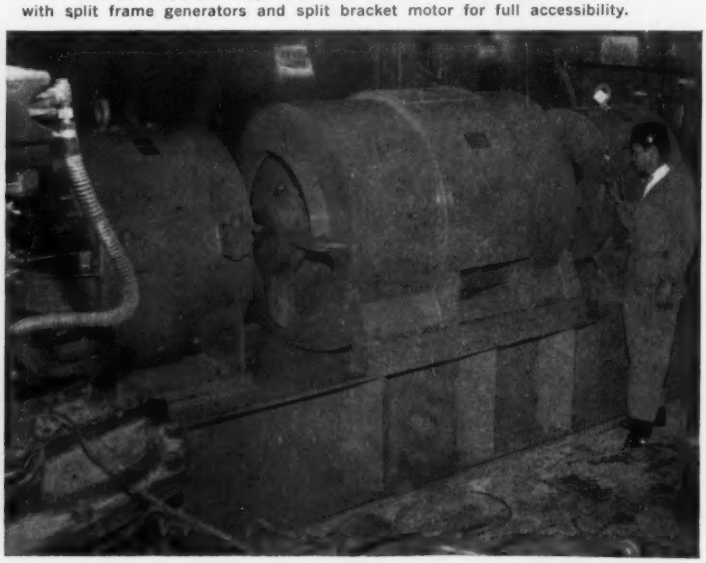
chains and sprockets, buckets, speed reducers, gates, conveyor components, transmission equipment.

Wheel excavator removes top overburden at Peabody Coal's Freeburg, Ill., strip coal mine. Main drive elements are: 1. Wheel drive motor, 2. Crowd motor, 3. Digging ladder conveyor motor, 4. Propel motors, 5. Motor-generator sets, 6. Stacker conveyor motors, 7. Ladder hoist motor.

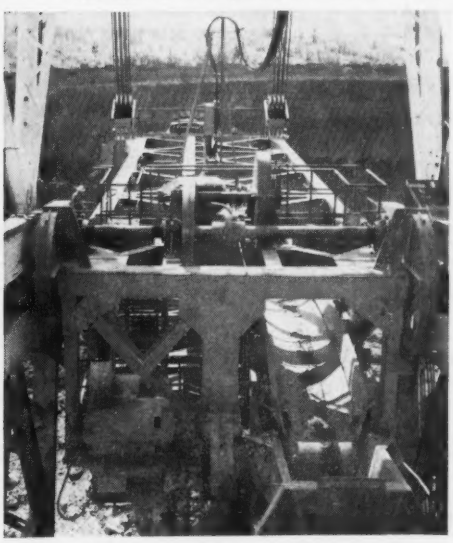
100 hp, a-c Westinghouse motor used for crowd motion.



One of two 1000 hp, 4 unit synchronous Westinghouse motor-generator sets with split frame generators and split bracket motor for full accessibility.



187½ hp forced ventilated d-c digging ladder conveyor Westinghouse motor (center, left) and 100 hp, a-c Westinghouse crowd motor (rear).



IN OPEN PIT OPERATIONS WESTINGHOUSE MOTORS AND WHEEL EXCAVATOR MAKE POWERFUL TEAM

As ratio of overburden thickness to coal seam thickness hits 20:1 or more (a 10:1 ratio was considered to be a break-even point only a few years ago), open pit operators continually search for new methods to remove overburden more economically.

An example of how one operator is tackling the problem is the Peabody Coal Company operation at its River King mine, Freeburg, Illinois. Peabody has teamed up a giant new wheel excavator with a large stripping shovel. The wheel excavator, manufactured by Bucyrus-Erie Company and exclusively powered by Westinghouse motors, removes the dirt and clay of the overburden. Behind the wheel excavator, the shovel scoops out the shale and hard rock to expose the coal seam.

Preliminary operations indicate that this "tandem" arrangement is much more efficient than a shovel working alone. But, an important part of the forecasted savings originates with the design and operation of the new wheel excavator itself.

It is capable of moving 3000 cubic yards of dirt per hour and depositing it 400 feet from the digging wheel to the spoil bank. Its crowd motion is up to 45 feet and driven by a 100 hp Westinghouse Lifeline a-c wound rotor motor with a-c reversing starters. This particular motor is well suited to the severe reversing, plugging service and frequent stopping and starting. The motor's rugged frame and feet assure maximum strength and rigidity to shock, vibration and physical abuse. The ladder hoist range of the wheel excavator is 40 to 100 feet at 15° angle and the motion is powered by a 150-300 hp Westinghouse d-c motor. A 90 foot long ladder conveyor operates continuously at 945 fpm and is driven by a 187.5-375 hp Westinghouse d-c motor. The Stacker conveyor extends 327 feet, moves faster (1260 fpm) than ladder conveyor to avoid pile-up of dirt at transfer point. This stacker conveyor and wheel employs two 250-500 ph Westinghouse d-c motors.

Swing motion of the new machine is operated by two 25-50 hp Westinghouse d-c motors. Low inertia armatures, greater field coil capacity, more torque per ampere — all features of Westinghouse motors — are particularly advantageous for this motion by allowing acceleration, deceleration, start, stop and reverse with a minimum of time and power. Exclusive Westinghouse insulation systems give maximum life and protection; mechanical designs include easily accessible motor leads, split steel frame d-c shovel type motors, steel shell field coil construction, maximum diameter shafts through punchings and with no overhung commutators.

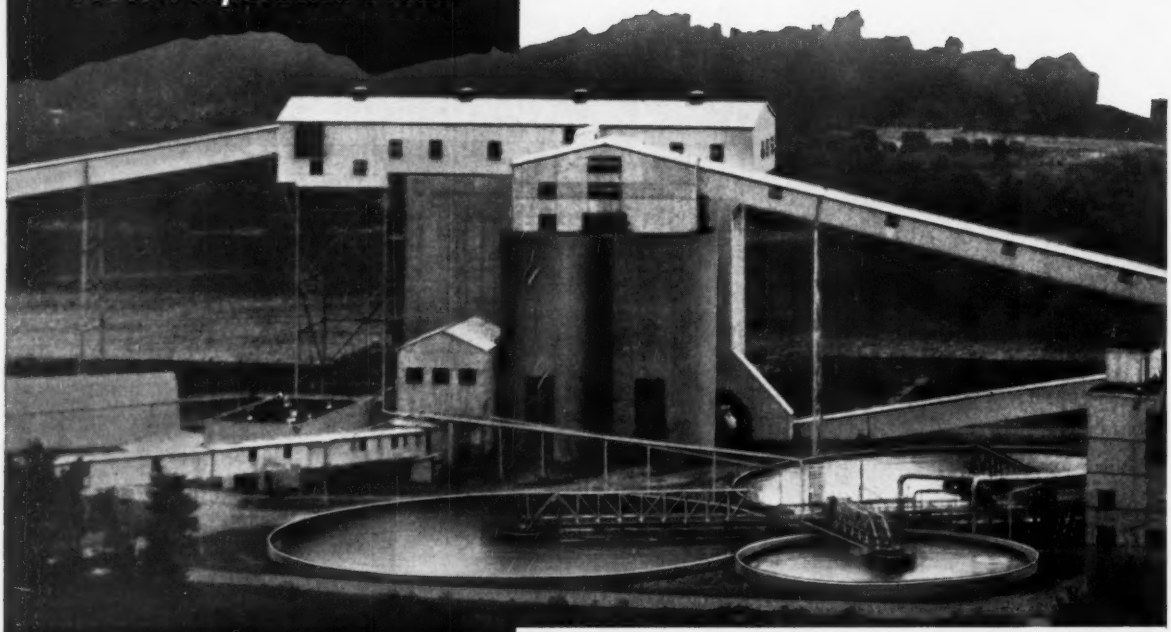
The 3,200,000 lb, 410 ft long, 180 ft high wheel excavator is propelled forward or reverse by four 100 hp, a-c Westinghouse motors, known throughout industry for reliability under tough operating conditions.

If you need information on how Westinghouse electrical equipment can help you realize greater operating efficiency at lower cost, see your Westinghouse sales engineer or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 22, Pa. *You can be sure . . . if it's Westinghouse.*

Westinghouse

J-96174

At J. & L. Vesta Preparation Plant



CYANAMID AEROFLOC® 550 Reagent

speeds up refuse settling, increases fine coal recovery, adds operating flexibility.

Cleaning thousands of tons of raw coal per shift, the Vesta preparation plant of Jones & Laughlin Steel Corporation is not only big but also efficient and flexible. Recently, both efficiency and flexibility were again stepped up by the use of AEROFLOC 550 Reagent.

Addition of this low-cost effective flocculant at the refuse thickener increased the settling rate of refuse solids to approximately 10 feet per hour with the overflow averaging less than 200 p.p.m. solids.

Added to the refuse and fine coal filters, AEROFLOC 550 produced results which far offset its small cost:

	Dry Tons of Filter Cake Per Hour	
	Without AEROFLOC 550	With AEROFLOC 550
Coal Filters	71.6	97.6
Refuse Filters	23.4	33.6

With AEROFLOC 550 it is not necessary to operate equipment between shifts, thereby saving on power costs.

AEROFLOC 550 effectiveness was demonstrated at the Vesta plant by Cyanamid's Mobile Flocculation Test Unit. With this unit it is possible to introduce a reagent at any desired point in a flow sheet and provide on-the-spot research on a practical scale without disturbing existing facilities.

For complete information on this service and on Cyanamid Reagents for the coal industry, contact American Cyanamid Company, Latrobe, Pa. or our nearest district office.

CYANAMID

AMERICAN CYANAMID COMPANY
EXPLOSIVES AND MINING CHEMICALS DEPARTMENT
BOUND BROOK, NEW JERSEY

SALES OFFICES: Denver, Colorado • Maynard, Massachusetts • Kansas City, Missouri • St. Louis, Missouri • Albuquerque, New Mexico New York, N.Y. • Tulsa, Oklahoma • Latrobe, Pennsylvania • Pottsville, Pennsylvania • Dallas, Texas • Salt Lake City, Utah • Bluefield, West Virginia
PLANTS: Latrobe, Pennsylvania • New Castle, Pennsylvania • Springville, Utah
PRODUCTS: High Explosives • Permissibles • Seismograph Explosives • Blasting Agents • Blasting Caps • Electric Blasting Caps • Blasting Accessories

DO IT THE EASY WAY WITH TIGERWELD WEDGE-TYPE BONDS

You don't need special tools to install Tigerweld wedge-type bonds, just a hammer and a drill. You'll have a bond that goes on quick and stays on. It's so dependable that many mines use Tigerweld wedge-type bonds instead of welding permanent bonds. But it's always easy to remove if the track must be relocated. You just hammer out the wedge. It's easy to see how this bond can save you time and money. For complete information, write American Steel and Wire, Dept. 1200, Rockefeller Building, Cleveland 13, Ohio.

USS and Tigerweld are registered trademarks

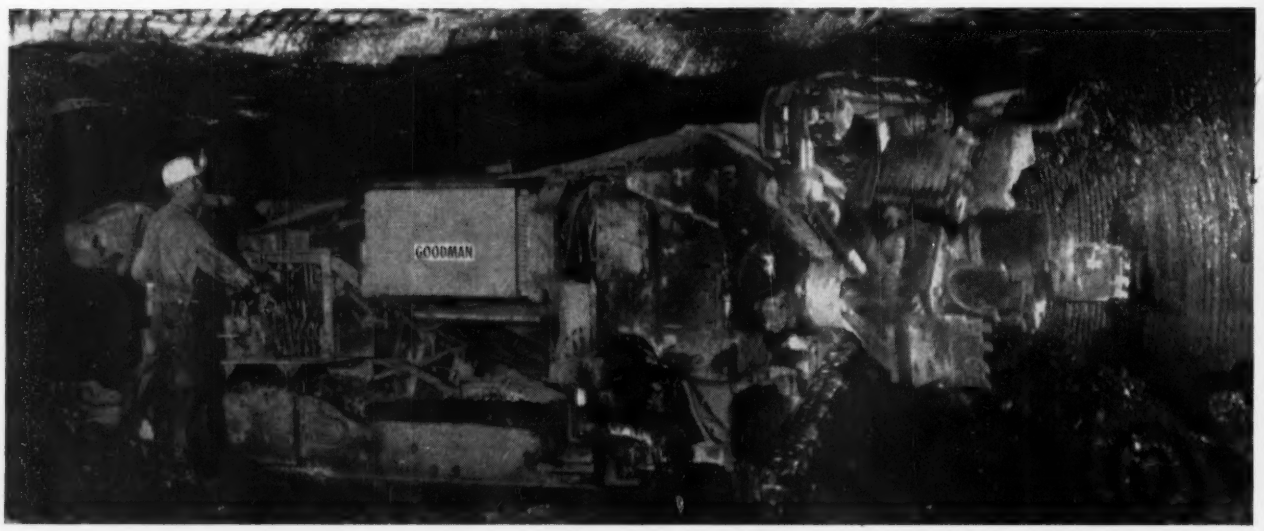
American Steel and Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

CONTINUOUS MINING

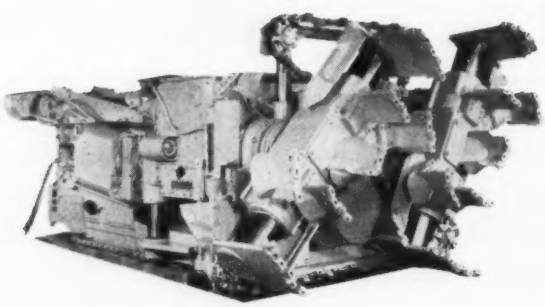
Extra productivity

. . . CONTINUOUS BORER



Goodman borers are rugged machines that have all the capacity, power and practical mobility needed for any phase of development work, room driving and pillar recovery. They are consistently developing areas at a rate of advance ranging from 200 to 300 lineal feet per machine shift; are producing tonnages in excess of 90 tons per face man for an entire mine. Low maintenance has been outstanding—at one mine a borer produced over one million tons of coal without need of an overhaul. At another property, six borers worked steadily for 2 years without an overhaul date even being scheduled.

This high tonnage, low down-time combination is built into every Goodman borer. It keeps men and machines at the working face—produces more coal with less supervision, makes the capital invested look better with each production report.



Goodman borers cut a path with arched rib and roof for natural support, produce a high percentage of coarse coal for maximum dollar yield.

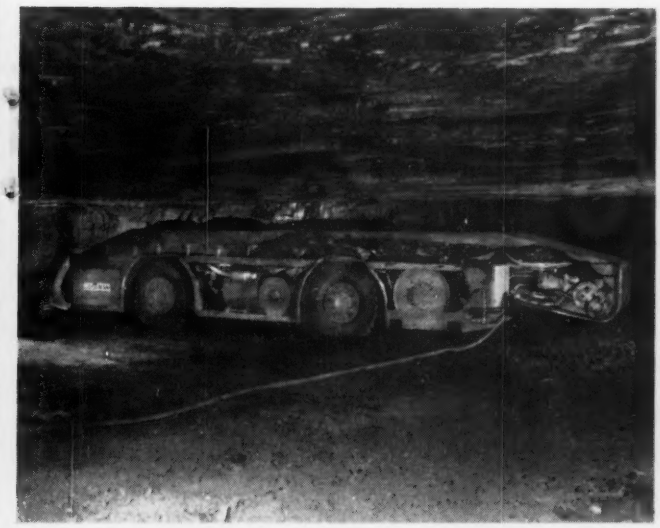
GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place, Chicago 9, Illinois

with GOODMAN EQUIPMENT

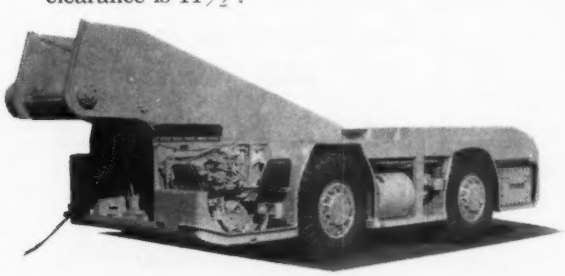
at low cost per ton

. . . SHUTTLE CAR



NEW—Now for big hauls use Goodman 1070 AC 10-ton shuttle car with 80 hp traction motor and a 26 hp motor for conveyor drive and hydraulic system. There are two tramming speeds without the use of clutches and torque converter . . . simple electrical, mechanical and hydraulic systems. Planetary type wheel units lessen wear on tram mechanism and produce high torque at wheel hub where needed. 10-ton capacity can be increased with sideboards.

The 1070 is available in basic heights of 44″ and 49″ and widths of 96″ and 106″. Ground clearance is 11½″.



. . . ROPEBELT® CONVEYOR

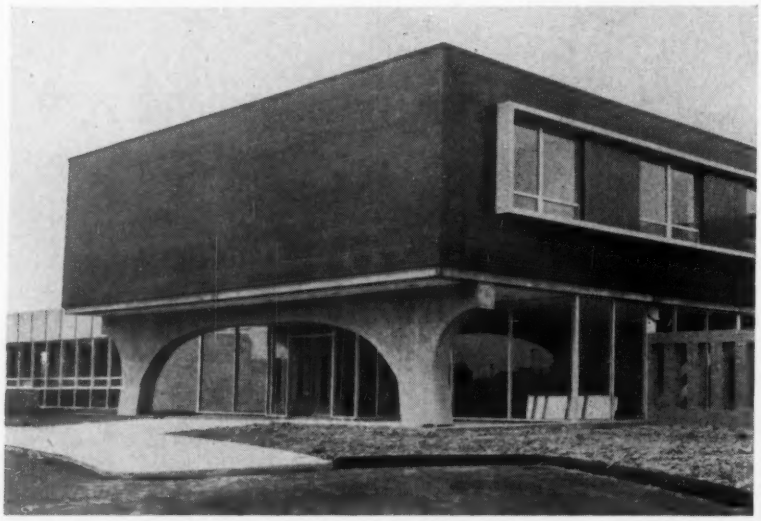
Practical for use anywhere in your mine—development headings, production panels, on main line or slope. Whatever its application, ground mounted or roof suspended, it pays off in speed of installation, high capacity, and low maintenance. Superior carrying capacity is particularly important for accepting coal from shuttle cars servicing continuous miners, and for mainlines that carry a mine's total production. Entire Ropebelt units can be quickly recovered and reinstalled.

Two improved Goodman full-flex carrying idlers available—the full-flex linked type, and full-flex low rope type that raises wing rollers above wire ropes (illustrated). Carrying capacity of both increases under load.

Since 1900 . . .
research, tools and skills to pace the coal industry's growth

A complete line of equipment for continuous and conventional mining systems.

News Roundup



HERE IS A PREVIEW OF THE NEW BITUMINOUS COAL RESEARCH CENTER at Monroeville, Pa., in a photo taken directly after the construction crew left the premises.

BCR Coal Research Center Opens

About the time this issue arrives at your desk, or on Oct. 9, all Bituminous Coal Research activities will be centered in the new laboratory at 350 Hochberg Rd., Monroeville, Pa. The new center represents the consolidation of research activities formerly conducted at BCR's Columbus, Ohio, and Pittsburgh, Pa., laboratories.

Under the direction of James R. Garvey, vice president and director of research, the program will emphasize development of improved coal utilization, methods and equipment. Financial and administrative functions will be supervised by John W. Igoe, secretary-treasurer and director of administration.

This laboratory will benefit the coal industry generally by offering a meeting place in its auditorium, which seats 120, for technical gatherings of government and industry groups on subjects related to the progress of coal through research. In addition to the auditorium, the main building consists of a chemical and engineering wing with individual laboratories and offices; a service area with a coal technology library, management offices and a cafeteria; and a full-scale test area with shop, stock room and related services. A smaller building houses coal preparation facilities, chemical storage and a garage.

In many respects the center is a demonstration building. Its cement block and structural concrete contain fly ash (residue of pulverized coal burned in electric utility plants) which provides economy and added strength. Also, the parking lot has a base of Pozopac, a lime and fly ash mixture. Electricity heats the laboratory and, in the main building, the test area and shop have resistance heating. The rest of the building is heated and air conditioned by electric heat pumps.

The laboratory will be dedicated at the National Coal Association convention at Pittsburgh, June 18-19, 1962.

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One of many projects intensively researched by BCR is the use of . . .

Coal in the Blast Furnace

A recent BCR announcement involves a new method and device for controlled introduction of solids into a stream of air against substantial pressures. This method will first be applied to the injection of coal into blast furnaces by Koppers Co., Inc. to whom BCR has given exclusive rights to the process. It has been estimated that the new process can save a market for 5 to 10 million tons of coal a year.

Koppers, a leading builder of blast furnaces for the steel industry, will have available the findings resulting from about 12 yr of intensive BCR research on this application. The two organizations are also conducting additional development programs on specific applications to enable Koppers to present to industry a highly-perfected installation for immediate full-scale application.

The new method includes a device called a "coal pump" which was developed by the Locomotive Development Program of BCR in their work on coal-fired gas turbines (see p 74).

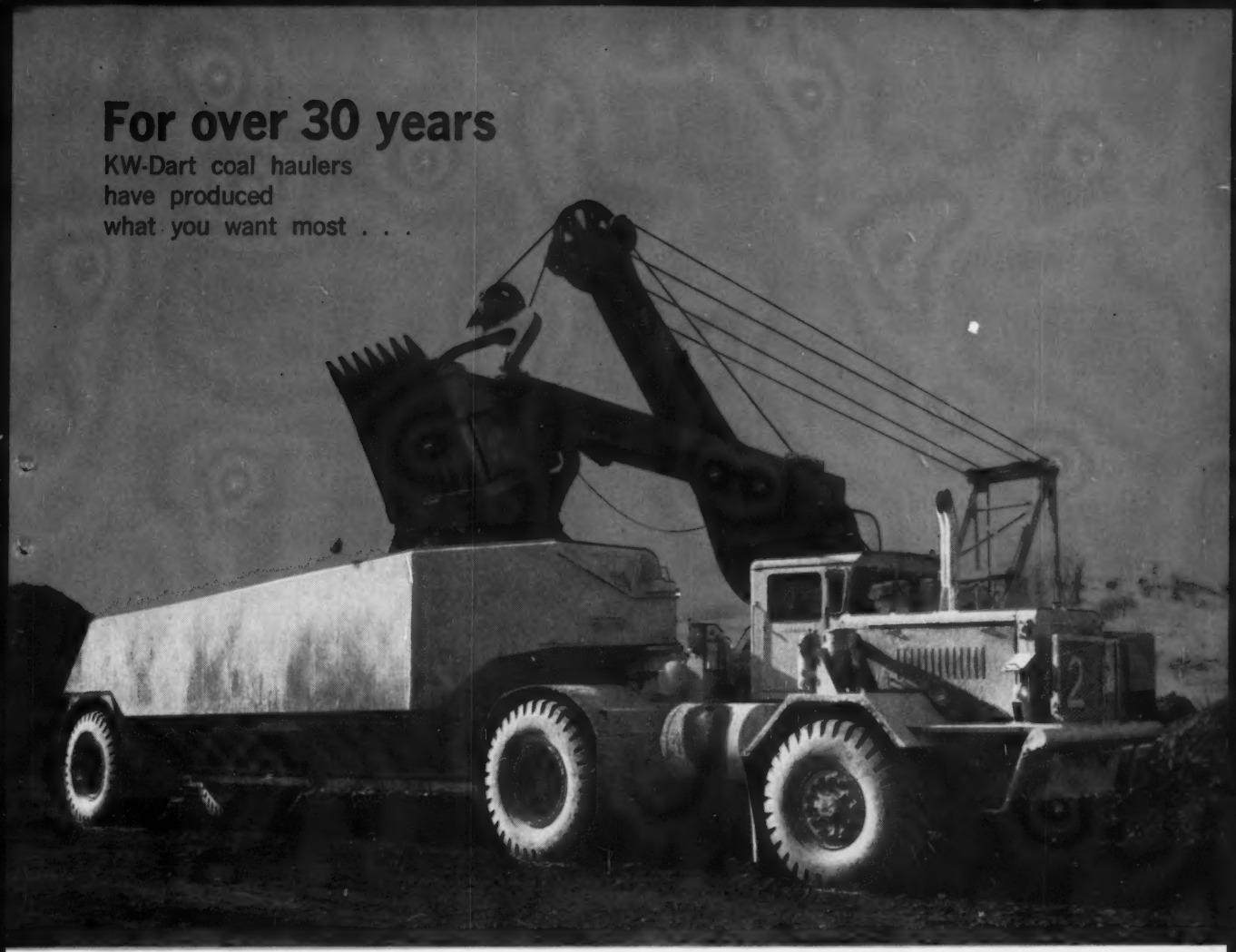
The injection of coal into blast furnaces to replace a substantial part of the normal coke fuel will be of great economic benefit to this metallurgical process in many areas, Koppers reports. In some cases, this injected coal will replace natural gas or fuel oil, both of which have been used commercially. Additional favorable results expected from this process are benefits to operation accruing from hydrogen released by the coal in the combustion zone, and the more complete utilization of blast-furnace gas by the use of higher stove heats.

Coal Operators Endorse C&O, B&O Merger

Numerous coal operators served by the Chesapeake & Ohio and Baltimore & Ohio railroads highly endorsed affiliation of the two roads at September hearings before the Interstate Commerce Commission.

C&O control of B&O would be good business and in the public interest, the ICC was told, and should also result in substantial improvement in B&O's car supply and service, and reduce its transportation costs.

Many of these operators testified that the chronically poor B&O service not



Lowest Haulage Cost Per Ton!

. . . that's why KW-Dart gets so many repeat orders for these units

30 years of working with the coal industry has given KW-Dart engineers a thorough knowledge of the problems of mine hauling operations: specific variations in pit widths, types of haul roads, grades, hauling distances, and loading shovel capacities. All these factors influence the design and building of KW-Dart haulers.

As a result — KW-Dart's job-proven coal haulers offer you maneuverability, a payload range of 50 to 100 tons, and a world-wide record for long service-life, minimum downtime, and smooth, safe operation.

For information on how KW-Dart haulers can boost *your* production, and lower your costs, write . . .

KW-DART® TRUCK CO.

1301 North Manchester Trafficway, Kansas City 20, Missouri, U. S. A.

only delayed deliveries but the unreliable transportation often discouraged producers from developing new operations. The C&O, on the other hand, was praised as a very efficient railroad operation which always displayed a willingness to consider competitive rate adjustments whenever 'necessary to assist the coal operators in retaining their markets.

Testifying to these conditions, endorsers included spokesmen from General Coal Co., Badger Coal Co., Downing Coal Co., Freeport Gas Coal Co., Robey Run Coal Co. and the Guaranty Gas Coal Co.

Senate Committee Approves Fuels Study

Paving the way toward the long-sought-after national fuels policy, the Senate Interior Committee approved Aug. 24 a resolution authorizing the committee to make "a full and complete investigation of the current and prospective fuel and energy resources of the United States" and a study of the "existing and prospective governmental policies affecting fuels."

An added provision to the revised national fuels policy resolution would empower the president of the Senate to add three senators who are not committee members. The purpose of this amendment was to strengthen coal state representation for the study. Senator Jennings Randolph (D-W. Va.), author of the original resolution, can be credited with having achieved this beneficial enlargement of the committee. Presumably Senators Randolph and Robert C. Byrd (D-W. Va.) will both be named to the committee in view of the prominent part they have played in securing its favorable consideration thus far.

The resolution now goes to the Senate Rules Committee which can report it to the Senate floor along with a recommended budget of $25,000 for the investigation. Then, if approved by the Senate as expected, the study will begin immediately. Under the amendment, the Interior Committee is authorized to report to the Senate at "the earliest practicable date" which may well expedite the report on the study since the original version was "not later than Jan. 2, 1963."

Flash: As had been anticipated, the Senate passed this resolution on Sept. 11.

WVU Establishes Coal Research Bureau

Another coal research bureau has been established, this one by West Virginia University. Its goal will be to achieve lower delivered costs of coal.

Working toward this end, the bureau will study coal mining, preparation and transportation in addition to marketing and utilization. Research projects, it has been reported, may also include coal gasification, in-state manufacture of metallurgical coke, extraction of alumina from clays and fine-coal cleaning.

Joseph W. Leonard, a former project engineer with U. S. Steel Corp., has been named director of the new bureau.

Gary, W. Va., Gets Modern Sanitation Plant

One of the most modern sanitation plants in the country recently started operating at U.S. Steel's Gary District, highlighting the corporation's continuing policy to cooperate in West Virginia's clean-stream program.

The first of its type to be installed in southern West Virginia, the filter-type sewage-disposal plant can treat up to 2 million gal of sewage daily. An integral component of the disposal plant is a modern laboratory located in the primary pumping and control house for sampling the plant's discharge to assure conformance with requirements of the West Virginia State Department of Health.

State, county and local officials together with union, industry and press representatives toured the plant when it was officially opened on Sept. 15. The guests also visited the district's modern water purification plant.

Private Utilities Plan National Electric Network

The nation's investor-owned electric utilities disclosed Sept. 11 a 10-yr, $8-billion plan designed to block public power advocacy of a nation-wide interconnected power network.

The plan, announced by Edison Electric Institute, the industry's trade association, was described as a "grass-roots" study representing the best possible approach to providing the required transmission for the future. It was emphasized that the industry's prime concern was to avoid wasting tax dollars by duplication of public and private power transmission lines.

Philip A. Fleger, president, EEI said: "By 1970 we expect all the major power systems to be capable of operating on an interconnected basis throughout the U. S." He insisted that the only way to build the nation's electric power supply was to meet local needs through individual companies, then by planning together across corporate lines on regional bases, to provide eventually a true national power network. To suggest growth initiated at the national level, would mean turning the present system upside down, he said, and likened it to attempting to build a pyramid from the peak rather than at its base. "We feel," he continued, "that before any government transmission projects are set in motion, this program should be taken into account by all concerned."

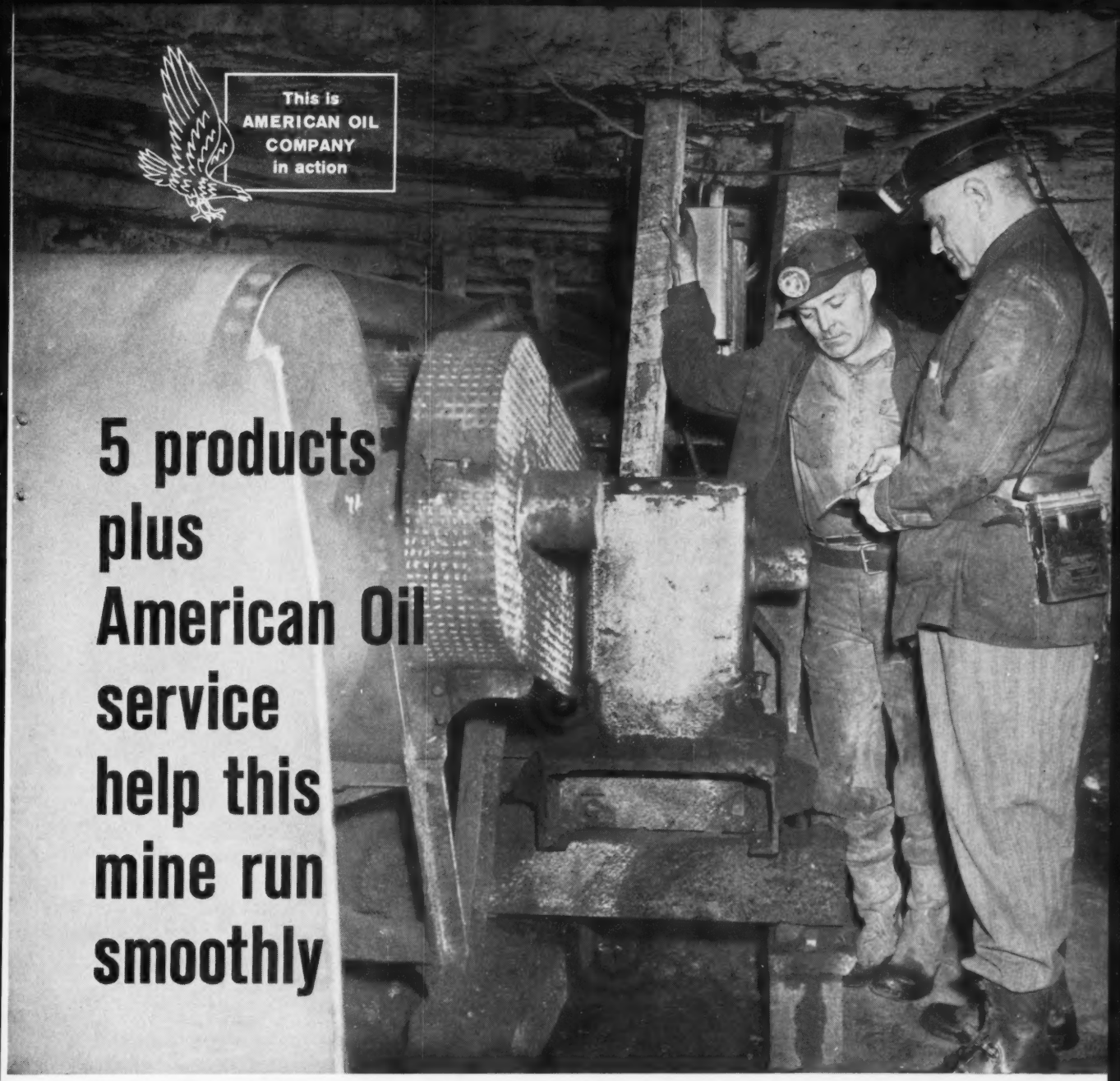
Public power reaction to the plan came six days later, on Sept. 17, when Interior Secretary Stewart L. Udall called for an overall plan for interconnecting and pooling facilities of the nation's public power systems with those of private utilities. He expressed hope that the EEI plan would open the way for a cooperative planning effort. In that connection, the secretary disclosed for the first time that he appointed a committee last April to join with representatives of EEI to study the possibilities of interconnections and pooling and the advantages of extra-high-voltage transmission. Mr. Udall said that in view of the institute announcement, he was hopeful the committee named in April "can now be activated fully and assume its responsibility in this important field of resource planning.

"It is our intention to examine the proposals of the Edison Electric Institute," he added, "to ascertain areas

(*Continued on p 62*)

This is AMERICAN OIL COMPANY in action

5 products plus American Oil service help this mine run smoothly



Mr. French Richards of the Pitfair Coal Company watches as American's Bob Chrisman checks temperature of conveyor belt lubricant.

By R. R. (Bob) Chrisman

About the Author.

Bob Chrisman is a specialist in solving the lubricating problems of mining. Holding a degree in mechanical engineering from West Virginia University, Bob has served commercial customers for 27 years. He has been with AMERICAN OIL COMPANY since 1941.

☆ ☆ ☆

The Pitfair Coal Company operation at Clarksburg, West Virginia, is a "slope" mine, tunneled deeply into the side of a hilly ridge. Throughout the mine itself and at the company's tipple, all equipment—cutting machines, conveyors, truck and loading devices—are lubricated by American Oil products especially developed for each type of service. The consistent trouble-free performance is one reason why Pitfair has relied on American Oil 100% since 1955.

Another reason is service. Whenever lubrication problems arise, the Pitfair people look to American Oil for helpful technical assistance, and they get it. For example, we recently helped work out a special system for handling the coal spraying operation.

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You can get the same kind of top quality products and service simply by contacting the AMERICAN OIL COMPANY office nearest you.

Pitfair Mine depends on these American Oil products

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16,000 ft. of neoprene-covered belting hauls jagged slate and coal to rail points at 250-300 ft./min. Installed in September '58, belt is specially designed for underground service.

LIGHTWEIGHT CONVEYOR BELT THRIVES ON HEAVY-DUTY SERVICE!

Still "like new"—despite nearly three years of brutal underground service! That's the latest report from Royalty Smokeless Coal Co.'s Medo No. 2 Mine, Clifftop, W. Va., following a recent inspection of the belt shown above. And here's the reason: covers of tough, resilient *neoprene* synthetic rubber, coupled with a unique, lightweight, all-synthetic carcass.

Neoprene's reputation for prolonging belt life is based on its resistance to conditions that pound the life out of ordinary belting. Flexible and fire-resistant, neoprene also defies abrasion and impact, protects belt carcass from oil and grease, moisture and mildew. And its high coefficient of friction minimizes spillage, slippage and "run out" at loading points—delivers maximum loads over the head pulley.

Next time *you* order belting, make sure it has a cover of rugged, longer lasting Du Pont neoprene. No other material has been so thoroughly proven in severe mining service above ground and below . . . as cable jacketing, conveyor belting and hose. For more examples to show how neoprene-covered belts are serving industry, write: E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department CA-10, Wilmington 98, Delaware.

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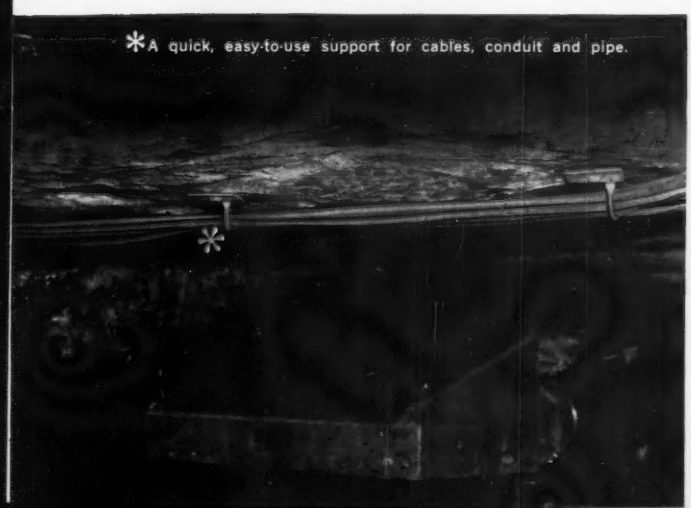
SYNTHETIC RUBBER

Better Things for Better Living . . . *through Chemistry*

O-B Designs for Mining Men

RESULT:
Better working conditions for men and equipment



*A quick, easy-to-use support for cables, conduit and pipe.

The O-B roof plate hook installs with one hammer blow.

- CLEARS MINE BOTTOM FAST AND EASY . . . cables, conduits and pipe go out of the way overhead leaving a clear way underneath for men and machines.
- PROTECTS ITS LINES FROM DAMAGE . . . saves costs because cables and other such valuable linage are held out of the way of wheels and feet.
- THESE HANDY HELPERS CAN BE USED OVER AND OVER AGAIN . . . once a section has been worked out . . . roof plate hooks can be reclaimed as easily as they were installed. This easy-to-use support moves with your operation! Order them from your O-B representative when he next stops at your mine. O-B Roof Plate hooks will make your mine operation safer and faster.

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10045-M

People in Coal

Top Post Marks Successful Coal Career

C. KYLE TIECHE, an old hand at coal mining with a successful career spanning 28 yr, has been elected president of Clinchfield Coal Co., a Div. of The Pittston Co.

A native of Coeburn, Va., Mr. Tieche attended the University of Kentucky and was graduated in 1932 with a B.S. degree in mechanical and electrical engineering.

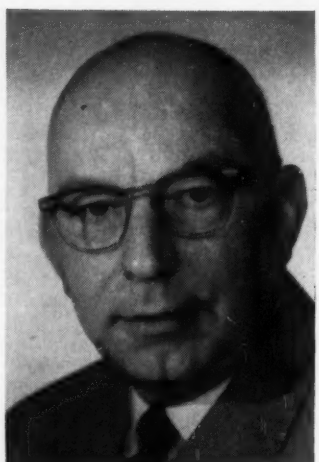
Making good use of his new-found knowledge, he began work in 1933 with the engineering department of the Virginia Iron, Coal & Coke Co., transferring to the production department in 1935. After successive jobs as assistant foreman, general foreman and assistant superintendent, he was assigned to the company's Lee County Div. as general superintendent of Monarch and Imperial mines. Then, in 1942, Mr. Tieche joined the Benedict Coal Corp. as general manager, remaining in that post until 1943 when he entered the U. S. Navy. After serving 3 yr in the Caribbean and Pacific areas as a lieutenant, he returned to Virginia and became general manager of the Banner Fuel Corp.

His first position with Clinchfield Coal Corp. was that of production manager when he joined in 1947. Forging ahead he became divisional superintendent of Moss and Meade operations in 1948 and general superintendent of Virginia mines in 1951. Then in Dec., 1952, he was named vice president in charge of operations, continuing in that capacity after the merger of Pittston and Clinchfield in 1956.

A member of the AIME, Mr. Tieche is also a director of the St. Paul National Bank and Lake Bonaventure Country Club.

The board of directors of the newly-formed **Beatrice Pocahontas Co.**, jointly owned by **Republic Steel Corp.** and **Island Creek Coal Co.**, recently elected the following officers. **R. E. Salvati** has been named chairman and chief executive officer and **J. L. Hamilton,** president. Both hold the same posts with Island Creek. **W. J. DeLancey, W. B. Boyer** and **N. T. Camicia** were elected vice presidents. Messrs. DeLancey and Boyer are also Republic Steel vice presidents while Mr. Camicia is vice president—operations, with Island Creek. In addition, **B. H. Early** who has been elected secretary and **F. C. Honchell,** treasurer, are also with Island Creek as associate general counsel and vice president—finance.

Dr. Henry R. Linden, research director of the Institute of Gas Technology, has been appointed director of the institute—an education and research facility for the utility gas industry. He succeeds **Dr. Martin A. Elliott,** who has been named academic vice president of Illinois Institute of Technology, an IGT affiliate, and will continue with IGT as executive consultant. Mr. Linden, employed by IGT since 1947, has authored or coauthored about 50 publications and holds a number of patents in the fuel technology field. He has received the Bituminous Coal Research Award and the Award of Merit of the Operating Section of the American Gas Association.



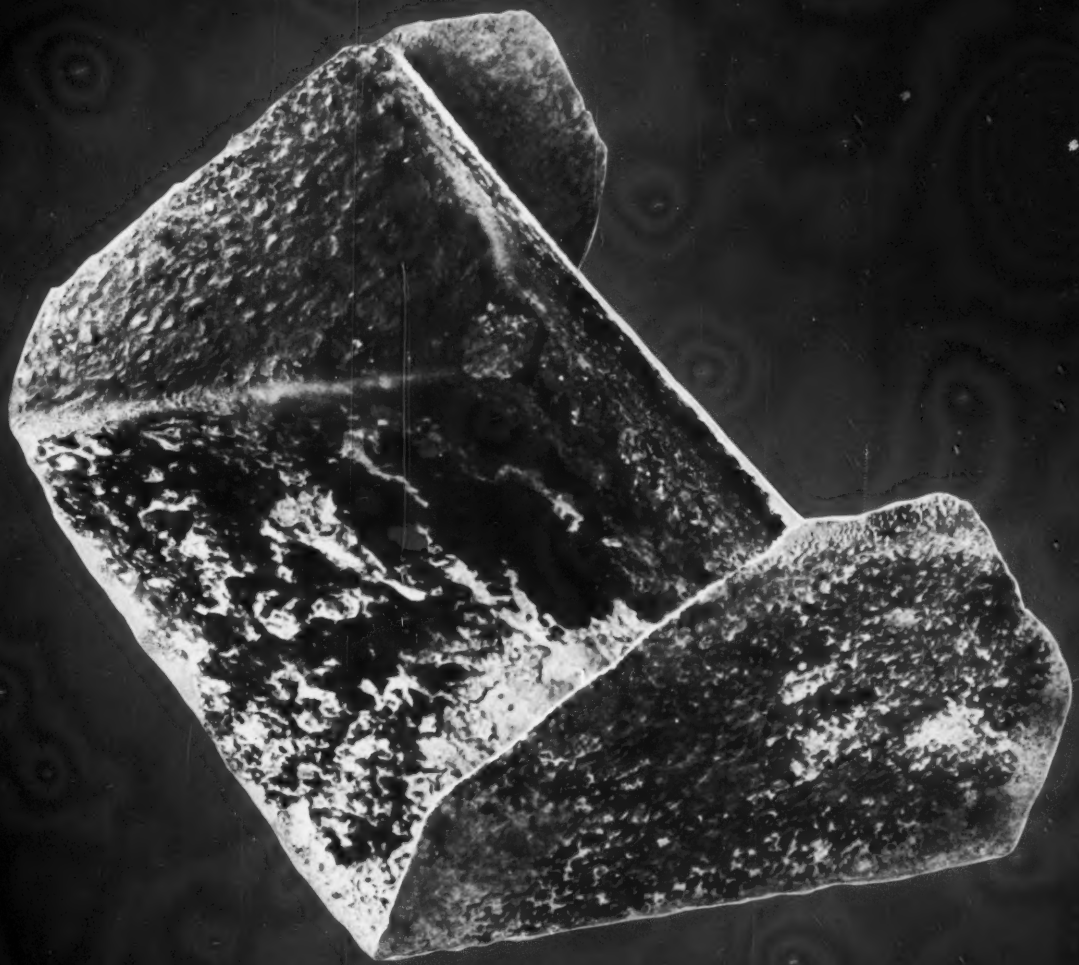
L. H. Chalfant, manager, **Bethlehem Mines Corp.,** has been chosen chairman of the Program Committee for the 1962 Coal Convention of the **American Mining Congress** to be held at Pittsburgh, Pa., May 6-9.

Mr. Chalfant, who manages his company's extensive coal-mining operations, will head a nationwide committee of mine operators and mining-equipment manufacturers in developing the convention program. The program will cover the important economic problems confronting the industry and the latest advances in methods and equipment for mining and processing coal.

On Sept. 1 **William J. Orlandi** assumed duties as director of the **Illinois Department of Mines & Minerals.** He was formerly assistant vice president, **Peabody Coal Co.**, St. Louis Div. Born in Kincaid, Ill., and a graduate of Purdue University, Mr. Orlandi replaces **Ben H. Schull** who had held the directorship since 1953.

J. S. Whittaker has taken on responsibilities as president and director of **Mathies Coal Co.** in addition to his duties as vice president—operations, **Pittsburgh**

(Continued on p 41)



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RUST-PROOF LINEAR POLYETHYL

WHAT IS LINEAR POLYETHYLENE?

To the layman, it's a tough plastic. Actually, this is a good definition, but it doesn't go far enough.

Linear, or as it is sometimes called, high density polyethylene, is in many applications a material far superior to and always more economical than stainless steel. Basically, Linear is CHEAPER, EASIER TO INSTALL, LIGHTER, REQUIRES LESS MAINTENANCE THAN METAL and is, of course, RUST-PROOF. "Hang ups", the build-up of material in corners and angles, is all but eliminated as Abutco linear polyethylene is self cleaning. Even cement may be removed by hosing. Also, in winter, there is no "freeze-up" as matter and ice will not adhere to Abutco plastic. This Linear is impervious to all caustics found in the handling of coal, such as "acid water" which in varying quantities is present in almost all coal handling areas. In the case where coal is moved by water, the amount is considerable. "Acid water" also results from rain and condensation. Wherever it appears, metal will deteriorate. With Abutco Linear, this can't happen. During shutdowns, whether overnight or for prolonged periods, matter and moisture will act on metal. Not only will the life of the equipment be shortened, but also start-ups must overcome deposits and rust before full flow efficiency can be reached. With Linear, this problem is eliminated.

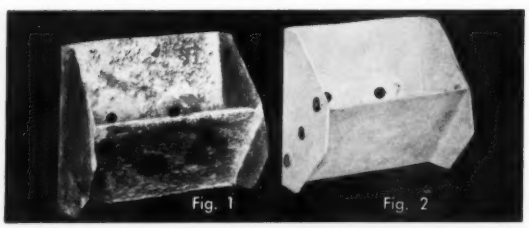

Fig. 1 Fig. 2

Illustrated in Figures 1 and 2 are buckets which have carried coal on a conveyor consistently for over six months. The metal bucket (Fig. 1) is almost worn out. The Linear polyethylene bucket (Fig. 2) is in virtually new condition. It is also interesting to note the Linear bucket weighs only 1/7 as much as the metal bucket which effectively solves the problem of slack. On a conveyor with several hundred buckets, this saving in weight could change entire power requirements of a facility.

Many mines and cleaning plants have used a very convenient and practical method of installing Linear. On chutes and other conveyors where plastic has been selected, Abutco has supplied fabricated inserts. These are dropped in on top of existing material (see Fig. 3) with little or no down time required. The old material becomes a permanent frame to support the new plastic liners. No more need to tear down chutes and strip old metal off. Eliminated also is the long job of cutting,

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ROAD CONSTRUCTION AND POWER SHOVEL CONTRACTS
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"...I think you should know how well pleased our bridge people are with the elephant trunks and tremies we purchased from you recently. Our carpenters much preferred your tremies to conventional ones because of the ease of handling, faster pours and minimum of time in clean-up."

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"...Tests that have been made prove po
satisfactory from all points including
chocolate from the mold as well as
transfer, and being odorless, tasteless
It can be seen that much can be saved thr
of plastics when we consider the cost of
about 20-25% the cost of our conventional

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"...Your plastic products have revolutionized many operations in the construction and mining industries. Their acceptance is growing in leaps and bounds.

Plastic has many advantages over steel. It is very light, it cannot rust or dent, it is not affected by acid materials cannot cling or stick to it and it will last much longer."

JEDDO-HIGHLAND COAL COMPANY
SOLE MINERS AND SHIPPERS OF
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JEDDO, PA

"...The polyethylene liners currently in our chutes have been in operation since April 1960, with the plant working on two-shift basis and approximately 115,000 tons of material having passed over them to date. Originally the polyethylene was fabricated to fit our chutes, but presently we are doing our own work.

As a comparison on wear, polyethylene already has given us equal wear as stainless steel and we expect it will outwear the stainless appreciably, as practically no wear has shown up. Its slipability with our type of material appears to be almost as good as stainless.

Besides the above, we have found that by ordering polyethylene in large sheets and by cutting, welding and bending it on the job ourselves, it is much easier and cheaper to install."

"...We have
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two years

Days whe
problem
other p
Abutco

YLENE!!

shaping and welding the new metal. In a matter of minutes, new Abutco Linear liners are in place and you are ready to roll.

Linear polyethylene by Abutco has met with success in many fields other than mining. It is presently being used extensively in the building industry for conveying cement. In the construction of bridges, forms developed by Abutco are rapidly gaining popularity. They are noted for their strength, light weight, and the extremely smooth finish they impart to the concrete. Numerous other items, such as mud flaps for trucks and safety shields for rotating equipment are being fabricated from Linear. Its resistance to wear and high visibility have proven to be the solution to many safety problems. Certain fleet truck owners are lining their trucks with Abutco Linear, thereby avoiding unnecessary delays in winter due to freeze-up and facilitating rapid dumping, as few, if any, materials adhere to this plastic.

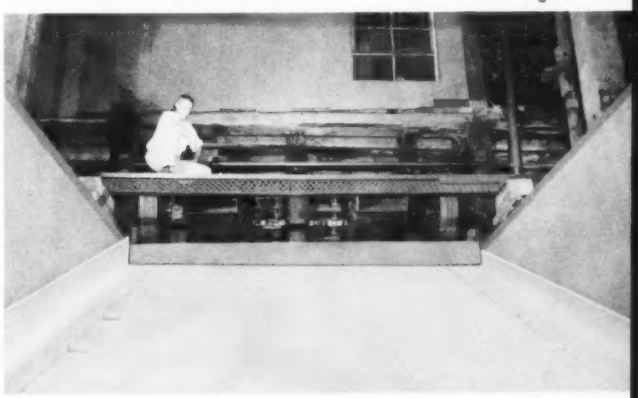
Literally, hundreds of applications of Abutco Linear Polyethylene have been found and the letters below are representative of numerous comments now in our files.

Investigate this material today. It could well be a solution to your problems tomorrow.

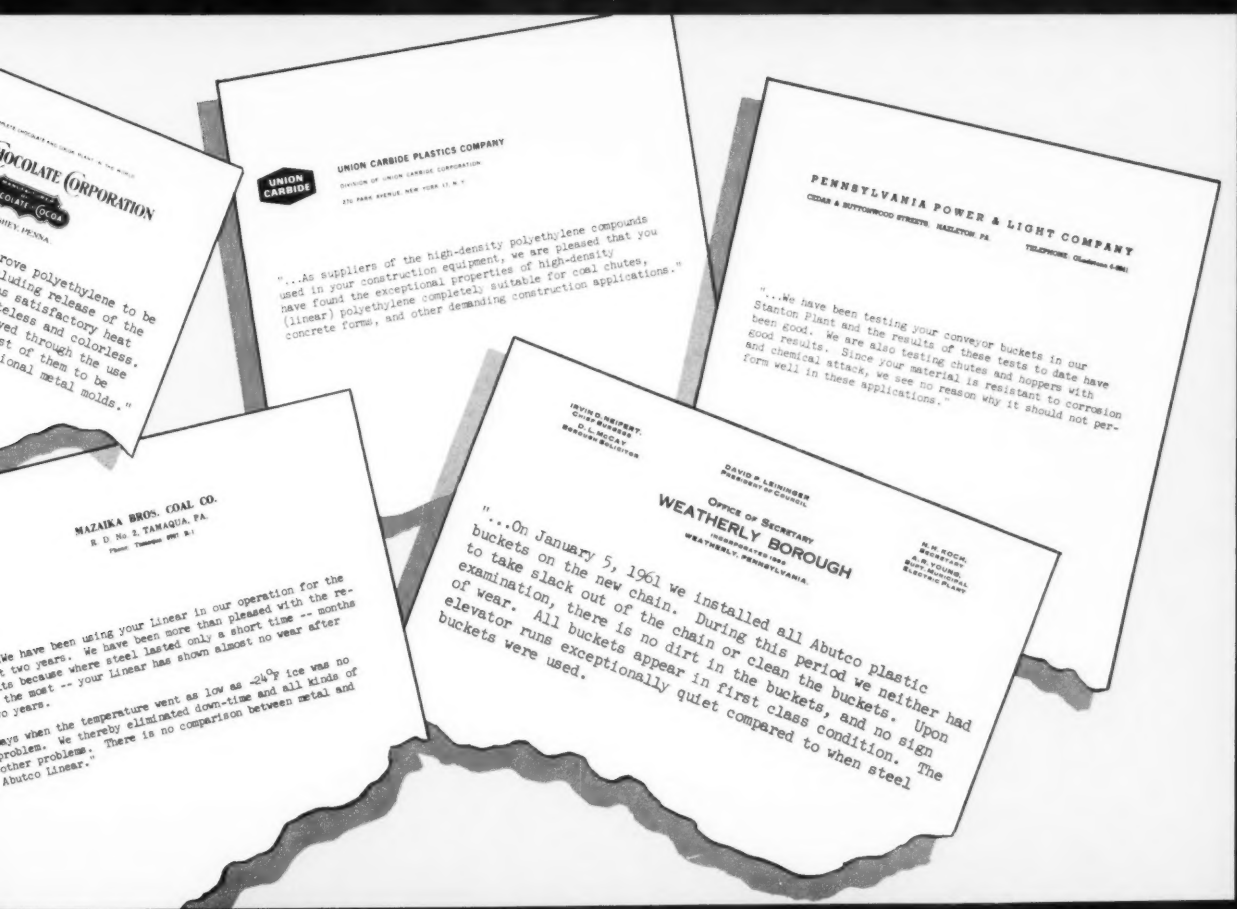
For additional information on Linear Polyethylene by Abutco, call or write today to Director, Sales Engineering Department, Abutco Plastic Industries, Inc., Hazleton, Penn.

A section of plastic chute is shown being installed as a replacement for steel at a major fine coal plant by technicians from Abutco Plastics Industries. The new chute liner is made from Linear polyethylene, produced and fabricated by Abutco. Fig. 3

Abutco's construction grade Linear, shown below as a liner for an anthracite coal pocket, outlasted metal. It has been virtually unaffected by acids, chemicals and abrasion. After two years of continuous hard service, this installation shows no apparent wear! Fig. 4



NEAR AND THEY KNOW ABUTCO



...rove polyethylene to be ...luding release of the ...s satisfactory heat ...eless and colorless. ...ed through the use ...t of them to be ...ional metal molds."

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DIVISION OF UNION CARBIDE CORPORATION
270 PARK AVENUE, NEW YORK 17, N. Y.

"...As suppliers of the high-density polyethylene compounds used in your construction equipment, we are pleased that you have found the exceptional properties of high-density (linear) polyethylene completely suitable for coal chutes, concrete forms, and other demanding construction applications."

PENNSYLVANIA POWER & LIGHT COMPANY
CEDAR & BUTTONWOOD STREETS, HAZLETON, PA.
TELEPHONE: Gladstone 4-8861

"...We have been testing your conveyor buckets in our Stanton Plant and the results of these tests to date have been good. We are also testing chutes and hoppers with good results. Since your material is resistant to corrosion and chemical attack, we see no reason why it should not perform well in these applications."

MAZAIKA BROS. COAL CO.
R. D. No. 2, TAMAQUA, PA.
Phone: Tamaqua 4987 R-1

...We have been using your Linear in our operation for the ...two years. We have been more than pleased with the re... because where steel lasted only a short time -- months ... the most -- your Linear has shown almost no wear after ... years.

...ays when the temperature went as low as -24° ice was no ...problem. We thereby eliminated down-time and all kinds of ...other problems. There is no comparison between metal and ... Abutco Linear."

IRVING D. REIBERT, CHIEF BURGESS
O. L. MCCAY, BOROUGH SOLICITOR
DAVID P. LEININGER, PRESIDENT OF COUNCIL

OFFICE OF SECRETARY
WEATHERLY BOROUGH
INCORPORATED 1885
WEATHERLY, PENNSYLVANIA

M. M. KOCH, SECRETARY
A. P. YOUNG, SUPT. MUNICIPAL ELECTRIC PLANT

"...On January 5, 1961 we installed all Abutco plastic buckets on the new chain. During this period we neither had to take slack out of the chain or clean the buckets, and no sign of wear. All buckets appear in first class condition. The elevator runs exceptionally quiet compared to when steel buckets were used.

ABUTCO

ENGINEERING CONSULTATION

As with all engineering problems, qualified technical people must be consulted. The engineering consultation staff at Abutco is trained to help their customers in the correct use of Linear polyethylene. These men will study your problems and recommend the best solutions. When necessary, they will assist in the design and supervise fabrication of units to best fulfill your needs. They will be the first to tell you if the application is not compatible with plastic, but they will also be the first to see where substantial savings and increased efficiencies can be effected through Linear by Abutco.

COST & ESTIMATES

Cost is dependent on three factors. First is the amount of Linear required. 1/8" thickness is the most common industrial size and presently sells for slightly over .60 per sq. ft.

Second is the fabrication required, if any. Many installations require none at all as Abutco sheet can be easily formed and fitted to shape. Third is the actual installation. This, in many cases, is done by the customer under the guidance of our men. We recommend the submission of sketches indicating the area to be lined, together with a description of the application. Based on this, an estimate can be prepared. If the installation is particularly complicated, our engineers will assist you.

DELIVERY

Abutco maintains a modern facility at Hazleton, Pa. Linear polyethylene to 1/4" is stored and can be delivered in quantity within a week of receipt of order. Skilled technicians will immediately undertake any fabrication and, as a rule, complete prototypes within 10 days. Certain standard configurations can be delivered from stock or modified with no delay at all.

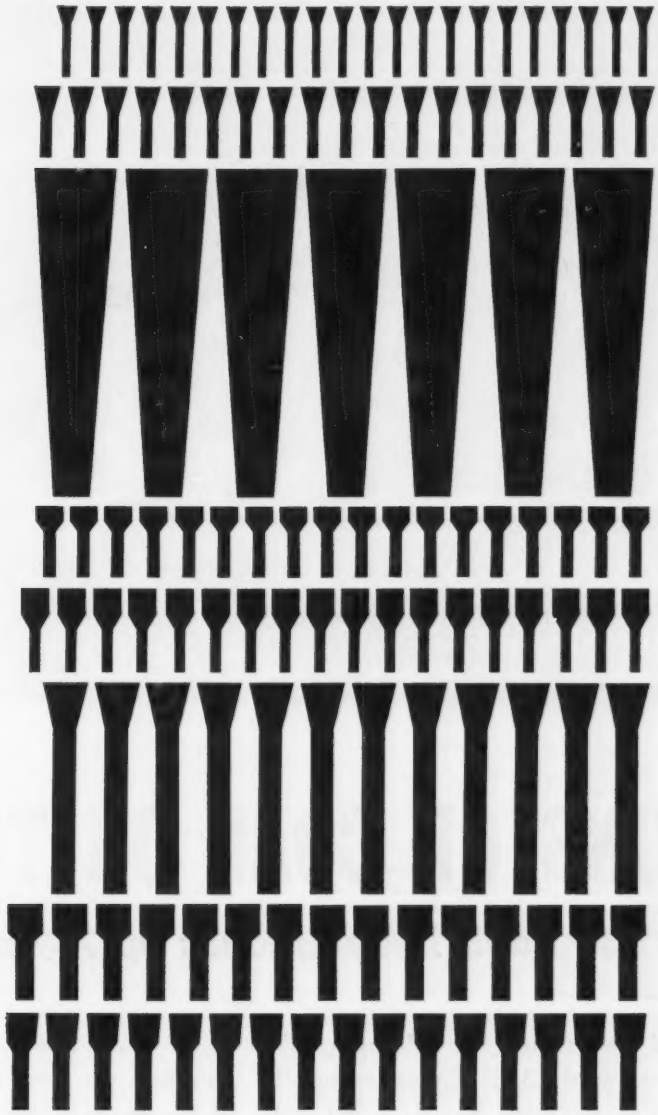
ABUTCO

PLASTIC INDUSTRIES, INC.

a subsidiary of

PENNSYLVANIA QUARRY, STRIPPING & CONSTRUCTION CO. * CENTRAL INCORPORATED 1903 HAZLETON, PA.

The main plant of ABUTCO PLASTIC INDUSTRIES is located on the grounds of its parent corporation. The executives of Pennsylvania Quarry, Stripping and Construction Co. are active in the management of Abutco and the entire facilities of this half-century old company stand behind Abutco offering customers a record of accomplishment and integrity.



Profiles you're bound to profit from

Hendrick Wedge Slot Screens are available in a complete range of sizes, with profile bars that are precision engineered to meet a wide diversity of screening requirements. Designed to insure maximum dewatering efficiency and resistance to abrasion, Hendrick Wedge Slot Screens have parallel head flanges that maintain uniformity of openings throughout the life of the screen. Wedge Slot is available with profiles specifically designed for heat dryers; dewatering following washboxes; water and sewage filtration; washbox bottoms; and coal, ore or sludge dewatering applications. For information on Hendrick Wedge Wire's free clearance, rugged mechanical strength, extra load carrying capacity and large percentage of open area, send in the coupon today.

HENDRICK Manufacturing Co.
Carbondale, Penna.

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens
Hendrick Wedge-Wire Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids • Hendrick Hydro Dehazers

HENDRICK Manufacturing Company
Dundaff Street • Carbondale, Pennsylvania

Gentlemen:

☐ Please have representative call.
☐ Please send FREE literature.

Name_____
Title_____
Company_____
Street_____
City_____ State_____

62 TONS OF COAL ON THE MOVE!

New Cat 630 hauls heaped loads up 7% grade at 6.3 MPH

Climbing out of the pit for 1/10 mile up a 7% grade, this 630 averaged 6.3 MPH, accelerating all the way—with a gross vehicle weight of 207,300 pounds. That's big-profit production and grade-ability!

Here's another example of the 630's grade-ability: on one run the machine was stopped 200 feet from the top. With a capacity load, it started again without spinning or bucking, smoothly accelerated and shifted into direct drive in about 15 feet. At the top it was ready to shift into 2nd range for a fast trip to the hopper.

The performance studies reported here were made on three Cat 630 wheel Tractors with matched PH630 Coal Haulers (built by Athey Products Corporation) owned by Truax-Traer Coal Co., Fiatt, Illinois. Total haul distance was 4.17 miles, weather was excellent and the haul road was hard and well-maintained.

If you've had a close look at the 420 HP 630 in action, you know what it can do--and why. But if you haven't, here are some facts that partially

NEW CAT 630-PH630
COAL HAULER

420 HP
(335 HP flywheel)

41.5 MPH
top speed

60 TON
struck capacity

LOOK AT THIS PRODUCTION

Performance comparison with a DW20 on a 4.17 mile haul road (including wait time)

	630	DW20
Average cycle time	29.8 min.	28.5 min.
Trips per 60 minute hour	2.0	2.1
Average payload	62.5 tons	46 tons
Production per hour	125.6 tons	97.1 tons

explain its ability to deliver high production and high availability at low cost.

Fact one: Cat power shift transmission—a new concept that automatically adjusts the machine to grade and road conditions. There are nine different speed variations but the operator need only concern himself with three speed ranges. Controlled by one lever, each range has three *automatic* shifts—torque divider drive, direct drive and overdrive. A dial indicator tells him when to change his speed range for the best travel speed. Result: split-second shifting, steady acceleration on grades and faster cycles.

Fact two: low center of gravity and balanced construction—give operators the secure feeling of stability so they push these units to the limit all the time. Even with capacity loads—60 plus tons of payload—the 630s handle well at speeds up to 41 MPH . . . and operators comment on the good ride and easy handling.

Fact three: full unit construction—easy serviceability. Range transmission can be removed as a unit with cable control and differential carrier; torque divider transmission is removable as a unit without disturbing the engine. Radiator, side plates and fan can be removed as a unit for servicing or to provide easy access to front of engine. Also, fenders tip forward for easy tire removal.

For *all* the facts on the 630's productivity, availability, operating ease and low-cost performance, see your Caterpillar Dealer.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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PRODUCE MORE AT LOWER COST WITH A 630

FARRELL-CHEEK

ALLOY CAST STEEL MINE CAR WHEELS AND HIGH PERFORMANCE PARTS

Essential parts for every coal mining operation, cast from finest carbon and alloy steels.

Wheels and Rollers • Sheaves and Wire Rope Fittings • Chain, Sprockets and Buckets . . .

MADE OF F85 ALLOY CAST STEEL

Far from ordinary, these highly specialized mine car wheels, electric furnace cast of F85 alloy steel, are establishing new performance and service life records in actual use. A Brinell of 350-400 is provided on treads and flanges with a high degree of ductile toughness in hubs and webs.

You'll want complete information on all F-C wheels and parts for coal mining. WRITE TODAY!

Finest Name in Cast Steel!

FARRELL-CHEEK STEEL CO.

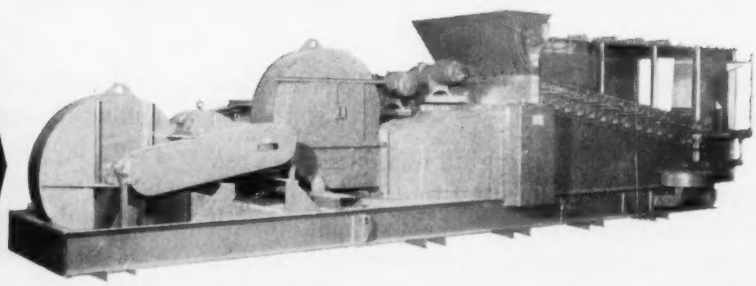
106 LANE STREET, SANDUSKY, OHIO

"FOUNDRYMEN FOR OVER FIFTY YEARS"

F85 F-C

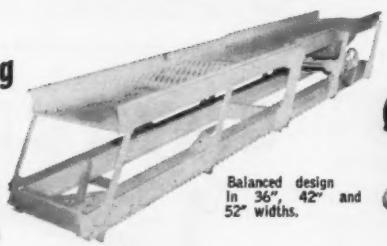
RIDGE AIRJIG Cuts Preparation Costs

- ONE COMPLETE UNIT
- ALL PARTS ON ONE BASE
- READY TO OPERATE
- 3 MODELS FROM 35 TO 75 T.P.H.



The Ridge Airjig combines efficiency with economy to give you the most practical, dry preparation of clean, marketable coal available. Separator, motors, blowers and controls are all mounted on one base . . . make the Ridge Airjig a complete, compact unit ready for immediate operation when placed under surge bin. Perfectly balanced rotating parts eliminate need for expensive, permanent foundation structures. Operates with top efficiency even on feeds with up to 8% moisture.

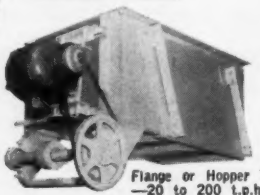
Other Ridge Equipment For Low Cost Handling Of Coal . . .



RIDGE TANDEM VIBRATOR SCREENS

Balanced design in 36", 42" and 52" widths.

RIDGE VIBRATOR FEEDERS



Flange or Hopper Types —20 to 200 t.p.h. capacities. ... 50 to ... t.p.h. feeds.

RIDGE EQUIPMENT COMPANY

Manufacturers of Heavy Media Plants • Screens • Feeders • Crushers • Conveyors

FRUGALITY, Pa. P.O. FALLENTIMBER, Pa. Phone: Altoona, Windsor 2-6435

Coal Co. A graduate of the Colorado School of Mines, he started with Pittsburgh Coal as a trainee in 1939. After serving as mine-rescue director, he was made director of safety in 1951, general superintendent in 1954, and vice president—operations in 1957.

Personnel shifts at **Consolidation Coal Co.'s Mountaineer Coal Div.** have been announced. **Robert H. Quenon,** formerly superintendent of Loveridge Mine, has resigned in order to return to college for advance study toward a law degree. He will be succeeded by **R. L. Dulaney,** who had been safety director of the Mountaineer Div. **J. G. Bowers,** long-time safety inspector and former mine superintendent, becomes safety director.

Associations

The Kentucky Reclamation Association elected a new board of directors and officers at its annual meeting Aug. 8 in Earlington, Ky. Board members are: Russell Badgett Jr., Russell Badgett Jr. Coal Co.; James Deane, Peabody Coal Co.; O. E. May and James Miner, Pittsburg & Midway Coal Mining Co.; O. N. Ranney, Riverview Coal Co.; James Sigmon, Sigmon Coal Co., Inc.; Bradley Sparks, River Queen Coal Co.; William Sturgill, Pine Bluff Augering Co. and Mountain Top Stripping Co.; R. H. Swallow, Gibraltar Coal Corp.; and Jesse O. Williams, Hart and Hart Coal Co.

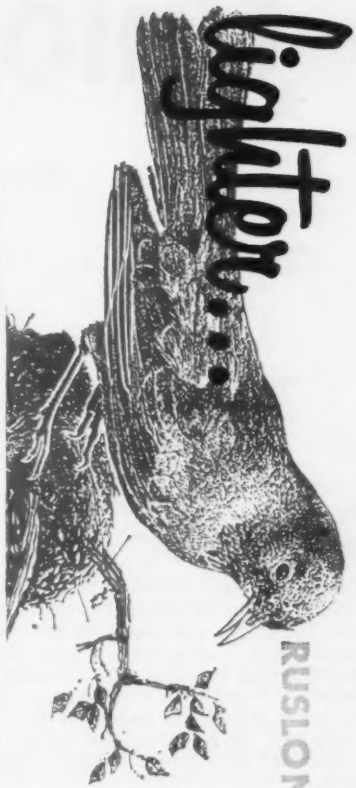
Officers elected by the board are Mr. Williams, president; Mr. May, vice president and Mr. Ranney, secretary-treasurer. John M. Crowl is executive director.

The Logan (W. Va.) Coal Operators' Association has elected Herbert E. Jones Jr., president, and William Crawford, vice president. Mr. Jones is president, Amherst Coal Co. and Mr. Crawford is vice president, Princess Coals, Inc. Directors elected are: C. E. Walker, executive vice president, Jewell Eagle Coal Co.; Stanley B. Johnson Jr., president, Lorain Coal & Dock Co.; L. E. Woods Jr., president, Crystal Block Coal & Coke Co.; Cecil H. Underwood, vice president, Island Creek Coal Co.; Frank Williams, president, Snap Creek Coal Co.; A. D. Scaggs Jr., president, Elkay Mining Co.; and R. D. Squibb, vice president, Omar Mining Co. J. W. Colley will continue as secretary-treasurer of the association.

Once again and for the tenth time in succession, the **Mining Society of Nova Scotia** met at Keltic Lodge, Ingonish Beach, Nova Scotia, Canada, June 29-July 1, for its 74th annual meeting. The order of events included the election of the following officers: President—Frank S. Jones, manager, Explosives Div., Canadian Industries Ltd., Halifax; first vice-president—Donald W. MacFadgen,

(*Continued on p 58*)

AN "ENGINEERS FOR TOMORROW PROGRAM" at Virginia Polytechnic Institute was sponsored and completely financed by the Women's Auxiliary of the AIME, Pittsburgh Section, to encourage interest in mining engineering among high school students. A fortunate but select group of 12 outstanding students, shown here with their professors, J. Richard Lucas (far left) and W. E. Foreman (far right), stayed at VPI's Blacksburg Campus for a full week. The group took all-day inspection trips to nearby Virginia mining operations including the Itmann Mine of Pocahontas Fuel Co. On the last day, a full schedule of lectures was presented on the promises and challenges of the mineral industries. The object of the lectures was to tie the newly-obtained knowledge gained from the trips to the requirements of a college career in mineral engineering. According to VPI, the limited experience with this program has dramatically shown that the fight against decreasing interest in mining engineering must be combatted with a positive program not only on the college level but more significantly at the high school level.



lighter...

RUSLON* PVC CONVEYOR BELTS OUTPULL, OUTLAST, MULTI-PLY BELTS

There is more to strength and wear-resistance than meets the eye. Feather-light Ruslon PVC belting (lighter and thinner than rubber!) outwears all other types of conveyor belts — holds splices better over longer distances.

Feather-lightness means better troughing, less spillage, easier handling and re-spooling. Light as a humming bird, but made for a whale of a job, this new belt beats the heavy-weights to the punch — and shows less stretch over distances to 3,000 feet.

*the trademark of Ruslon Fenaplast Diamond conveyor belts.

THE RUSSELL MANUFACTURING COMPANY

Middletown, Connecticut

Distributed by West Virginia Belt Sales, Inc., Mount Hope, West Virginia

Union Wire Rope

When the going gets tough-- Tuffy gets going,

Victim of the Bends

Excessive bending of wire rope accelerates wear. Generally, more flexible ropes are used as bending stresses increase (with decrease in tread diameter of sheave or drum). If a rope is operated on a sheave too small for its bending characteristics, early failure is certain. Through an exhaustive series of bending tests, Union Wire Rope engineers have compiled data that you can use to assure getting the rope construction that will give you the longest service life. Ask about it.

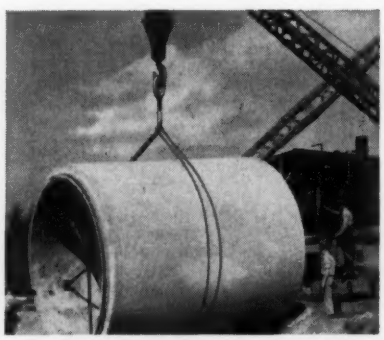
Kick Out Worn Sheaves

Old sheaves may never die, but in "fading away" they develop conditions which shorten rope life. Sheaves with grooves corrugated with rope lay impressions should be replaced with new ones before new wire rope is installed.

Union Tuffy's on these jobs give you the ultimate low cost.

Tuffy Scraper Rope

Flexible enough to take sharp bends; stiff enough to resist looping and kinking when slack; highly resistant to the shock of load impact — that's Tuffy balanced construction. Mount a reel on your scraper—save wasting sound rope.



Tuffy Slings and Hoist Lines

Slings are a patented, 9-part machine-braided wire fabric that is next to impossible to knot or kink. Hoist lines have built-in strength, toughness, flexibility. Balanced—a top-performing team for handling every type of material. In addition to Tuffy, Union Wire Rope furnishes a complete line of slings.

Tuffy Dozer Rope

Mounts right on your dozer in a 150′ reel. When rope shows wear, just feed through enough to replace the damaged part. Saves rope, gives you a bonus of extra service. Also available in 300′ and 500′ reels.

The Union Wire Rope Organization Gives You... RIGHT-NOW service with the RIGHT rope. Get set for quick action. Vast Union Wire Rope facilities assure fast delivery of just the wire rope or sling you need. More than 1600 standard constructions are available *plus* the famous Tuffy family of ropes and slings tailored to special needs. Hundreds of distributors and 15 strategically located warehouses help you meet emergencies—cut wasteful down-time. Call your Union distributor. He's listed in the phone book Yellow Pages.

Tuffy® Tips

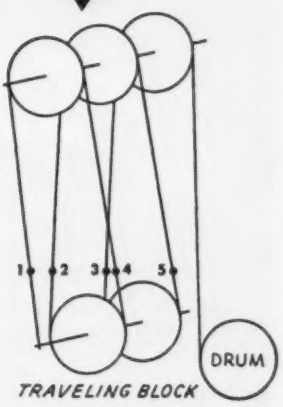
and keeps going longer if not abused

New steels are born at Armco

Diameter of Rope	Min. Dia.	Max. Dia.
¼ - 5/16	+ 1/64"	+ 1/32"
3/8 - ¾	+ 1/32"	+ 1/16"
7/8 - 1⅛	+ 3/16"	+ 3/32"
1¼ - 1½	+ 1/16"	+ 1/8"
1⅝ - 2¼	+ 3/32"	+ 3/16"
2⅜ and larger	+ 1/8"	+ ¼"

Recommended groove sizes:

New ropes are usually over-size. It is advisable to have groove diameters of sheaves or drums as large as the actual calipered diameter of the new rope, or slightly larger. We recommend sizes as (above) charted.

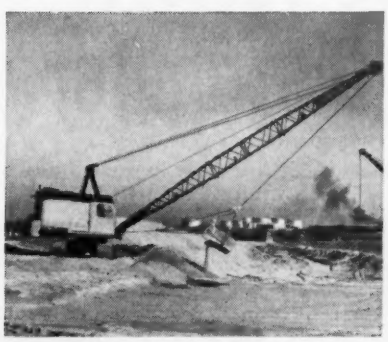


How to Figure Reeving Loads

Reeving ropes through the sheaves multiplies the number of parts supporting the load. The lead line to the drum carries the weight of the load lifted, divided by the number of parts, plus the accumulation of friction on all sheaves.

To count the number of parts supporting the load, draw an imaginary line across the parts of the rope supporting the load.

The efficiency of reeving systems ranging from one to eight parts is shown in charts which Union Wire Rope engineers make available to users.

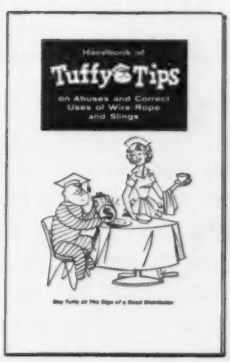


Tuffy Dragline Rope

High abrasive resistance and super flexibility. Gives long service, dependable action in handling any material—wet or dry dirt, sand, gravel, rock, minerals. Rides smoothly on grooves—hugs the drum when casting for full load.

Union's Handbook of TUFFY TIPS—Free!

The "Tuffy Tips" shown here are quoted right out of Union Wire Rope's handbook. In it there are dozens of other priceless hints on the correct use of wire rope. The common abuses and how to avoid them. How to save costly injuries. Maintenance tips. The proper fittings and how to apply them. Recommended sizes. Many other facts and suggestions that will cut down your rope costs and help you get out of wire rope the full service we build into it. No charge. Write Union Wire Rope, Armco Steel Corporation, 2130 Manchester Avenue, Kansas City 26, Missouri.



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ARMCO Union Wire Rope

• CARMET—FAMOUS FOR QUALITY • CARMET—FAMOUS FOR QUALITY

Your best bet in Mining Tools... your coal country Carmet® Distributor

Local people sell Carmet Mining Tools. Because Carmet believes in, and recommends, business on the local level. Your Carmet Mining Tool Distributor is a home town business man . . . a local employer. His prosperity stays in the local business community.

And, local buying is your best way of buying. Because each Carmet Distributor is selected on his own merit, and on his ability to offer specialized service in his own mining area. He can make his mining tools perform in *your* conditions. Because he knows what you're up against. And because he is a mining tool specialist. Carmet sees to that.

Your Carmet Distributor has plenty of support. Because Carmet sees to that, too. Carmet backs-up their distributors with direct plant engineering service . . . any time, anywhere. The 7 leading Service Engineers total over 154 years of direct coal mining experience. The oldest is 49. And they, in turn, have the industry's most complete line of carbide grades behind them.

This carbide is Carmet Carbide, of course . . . famous for quality. Carmet manufactures the bit completely, and stands behind it . . . completely. *Nobody* makes it for us. Because nobody can do it well enough. Call your local Carmet Distributor today, and let him show you the best Mining Bit that know-how and money can build. You owe it to your community. You owe it to yourself. 3677

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CEMENTED CARBIDE • DIVISION OF ALLEGHENY LUDLUM

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• CARMET — FAMOUS

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FOR QUALITY • CARMET

Coal Abroad

Compulsory Oil Price Publication Sought

Suggestions to introduce compulsory publication for mineral-oil prices before they take effect were rejected in a draft completed by the Interexecutive Working Committee for Energy Coordination of the Common Market Authority. The rejection dashed coal's hopes of gaining a more equal footing with oil since the European Coal & Steel Community regulations requiring publication of coal prices before they become effective do not apply to oil prices.

The Common Market committee said it will, nevertheless, strive to adapt competitive conditions of coal and mineral oil. One possibility suggested is compulsory price publication for oil *after* transaction has taken place.

This would give coal the opportunity to adapt its prices to the oil level. However, legal views differ on whether the Common Market Treaty, as written, could subject oil to such price publication.

Two other possibilities mentioned in the draft are voluntary self-control plus price publication by the oil companies, or introduction of national regulations imposing compulsory price releases.

The idea of subjecting oil to identical price publication compulsion as coal was rejected by the committee on economic, practical and legal grounds. As worded in the draft:

"It is not economically justifiable to introduce compulsory price publication with the obvious intention of curbing price cuts on the mineral-oil market and thus indirectly protect coal. Coal protection could better be achieved by quotas, tariffs or subsidies.

"In practice, the large number of oil companies make compulsory price publication look not very promising. Additionally, the committee sees little chance of preventing secret discounts on a market characterized by oversupply.

"Legal chances are dim because such a step would necessitate an alteration of Common Market regulations. Agreement on such alteration would be especially difficult because such a clause would apply only to the mineral-oil industry in the Common Market area out of all producers."

Defense Seeks U. S. Coal for Troops in Germany

To boost the economies of some U. S. labor surplus areas as well as improve the U. S. balance of payments position, the White House has ordered the Defense Department to invite bids from U. S. coal and coke producers to supply the needs of U. S. forces in West Germany.

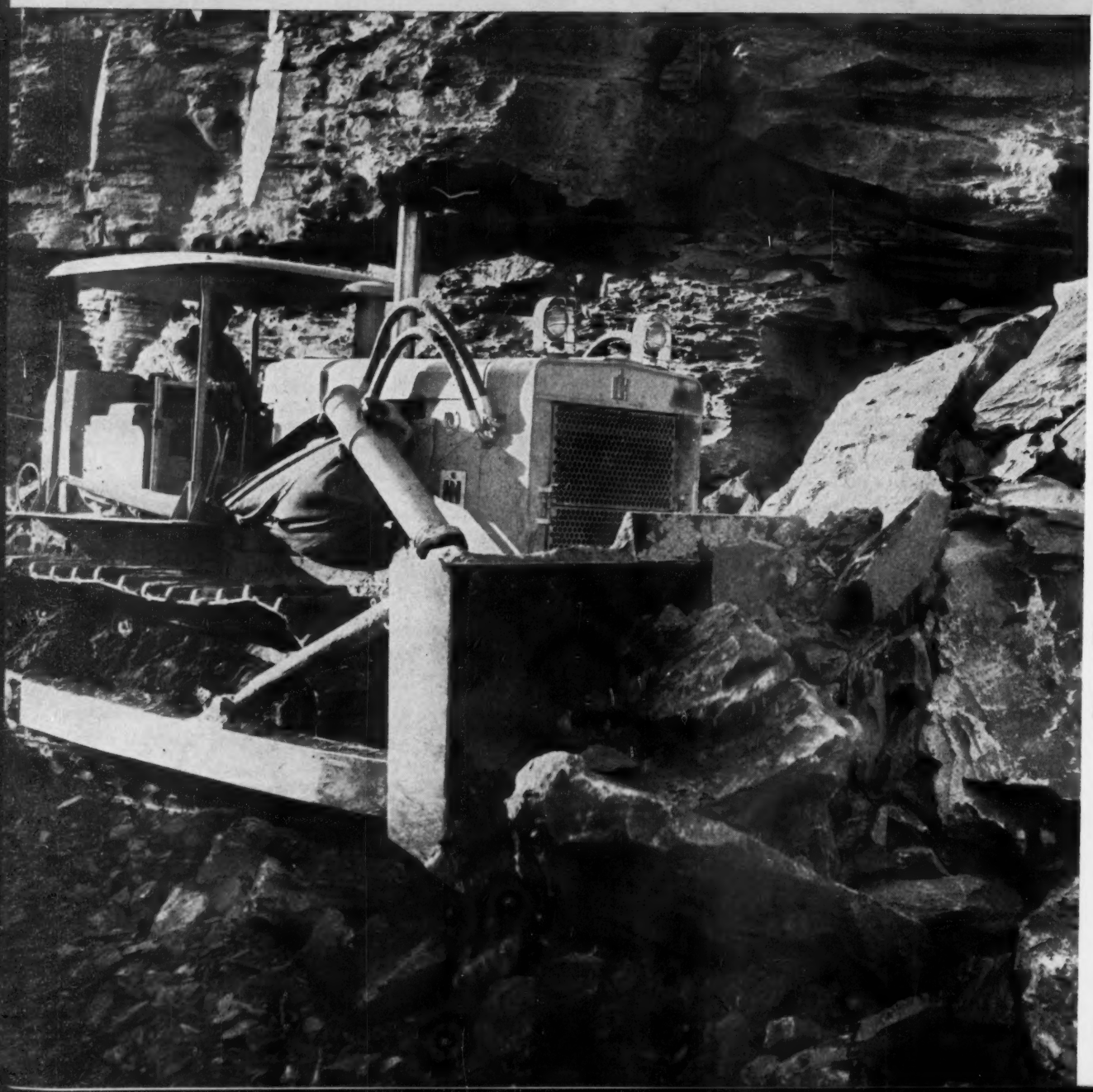
These forces use about 1,025,000 metric tons of solid fuels annually which in recent years had been purchased from foreign producers. Last May the Army announced that the bituminous coal in that total—305,000 metric tons—would be limited to coal from the U. S. but that the remaining 720,000 metric tons of coke would be bought on the international market. Since that time contracts for 280,000 metric tons of the coke portion have been awarded. The new White House announcement said it was later discovered that either coke or anthracite would fill many of the requirements so new bids have been invited on the remaining 440,000 metric tons, limited to U. S. sources, for the current fiscal year.

Overseas Flashes

INDIA—One of the larger mining enterprises proposed in the third 5-Yr Plan is a $200 million coal-by-wire project at Neyveli, in the state of Madras, which will get underway this month. Several countries assisting in the plan include the U. S. which first blueprinted the mine several years ago. The project's target output is an annual 4.8 million tons, about a third of which will be fed to the Russian-erected thermal-power station scheduled to produce 400,000 kw. The remainder will be used by a fertilizer plant and briquetting and carbonizing plant.

GREAT BRITAIN—The British Government has rejected the Tunnel Portland Cement Co. Ltd.'s application to import cheap Polish coal in a bid to reduce fuel costs and meet overseas competition. The company which had switched from coal to oil was forced to take a second look at coal after the April tax on fuel oil once again impaired its competitive position with its Continental counterparts. Before considering Polish coal, the company attempted to get supplies from the National Coal Board but so far have been unsuccessful. Company chairman N. M. Jensen said: "Not only is the quality we require not available but prices have again risen substantially; yet at the same time suitable British coals are sold to some of our competitors on the Continent at prices about two-thirds of those we are being asked to pay." For some time the NCB has been selling coal in Europe at below-U. K.-prices in order to maintain a footing in traditional markets. The grade sought by the company was sold to other markets after the switch

TD-25 outproduces '24' New Power advantages high-walling—*for Morris Enterprises,*



by 20%... speed

Owensboro, Ky.

"The new International TD-25 is giving us about 20% more production than our TD-24," states Paul H. Morris, owner of Morris Enterprises, Owensboro, Kentucky. "The '25's' DT-817 turbocharged Diesel is snappy, doesn't lug down, and has the power to carry full loads without hesitation.

"I particularly like my '25's' Planet Power steering and Hi-Lo power-shifting advantages for high-wall cutting—and the good balance, which enables backing up steep grades and starting the push immediately.

"My TD-24 has clocked better than 10,000 production hours in four years, with outstanding service and very low downtime."

Full-cut benching—full time

Apply full power to the job—maintain full speed—keep the blade loaded full time—benching or high-walling with the International TD-25. You simply operate the bankside track in high speed range, the other in low speed range—for full-capacity straight ahead performance, without "fish-tailing" or "bank-nosing."

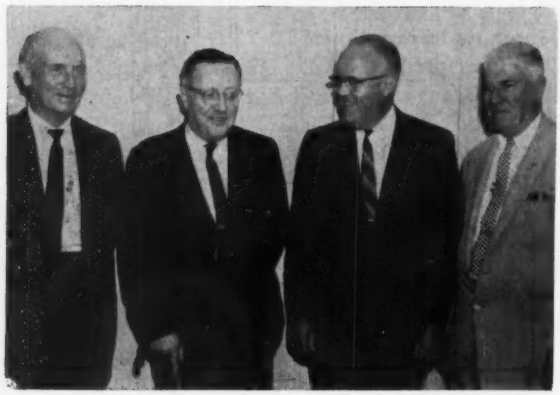
You make full-load, full-power turns with TD-25 "live-track" Planet Power steering. And with combined Hi-Lo power shifting, you get instant up-or-down matching of power to condition. You eliminate "dead-track drag" and "gear-shift" lag—and benefit accordingly.

See how the 230-hp TD-25 outproduces king-sized clutch-steered rigs by up to 50%, or more—clearing land, removing overburden, highwalling, and benching. Compare DT-817 turbocharged Diesel wallop—measure how dual-valving insures "free breathing" for clean combustion and big work capacity at all altitudes. Let your International Construction Equipment Distributor demonstrate.

"Slugging" straight ahead with an offset load of shot rock, this TD-25, belonging to Morris Enterprises, demonstrates the capacity-adding Planet Power steering principle. Operator keeps bank-side track in high range, leaves other in low range, to stay on course, with full power "harnessed." This producer removes about half of a 35' overburden with crawlers—takes off the balance with dragline.

International®
Construction
Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE



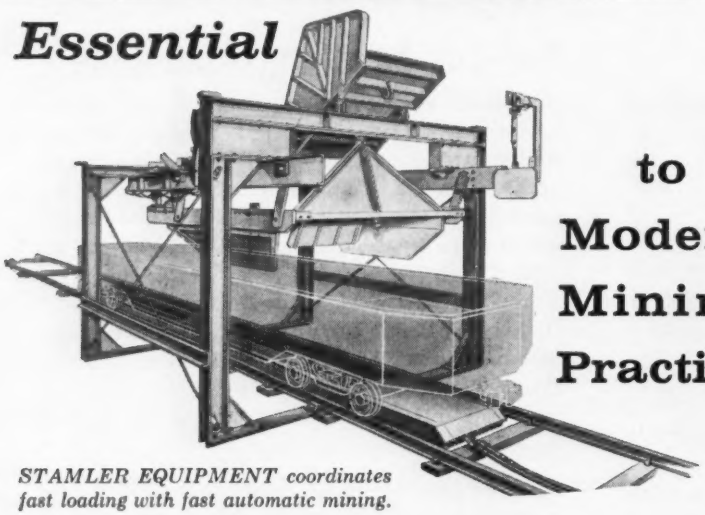
LAURENCE E. TIERNEY JR., (second from left), appointed by President Kennedy, represented the United States at the Coal Committee meeting of the Economic Commission for Europe which took place Sept. 18-20, in Geneva, Switzerland. With Mr. Tierney are two previous delegates to the committee: George A. Lamb (left), director of the Office of Coal Research; and T. Reed Scollon, chief, Div. of Bituminous Coal, U. S. Bureau of Mines. At right is G. Don Sullivan, associate director of government relations of the National Coal Association. Mr. Tierney is president of Eastern Coal Corp., Bluefield, W. Va., and an NCA director.

to oil, and when the company changed back, this quality was no longer available, NCB explained.

In view of this latest request for foreign coal, the Government's action of several months ago denying a steel company permission to import U. S. coking coal, may develop into a precedent-making decision on foreign vs local coal for Britain.

Meanwhile, a seagoing boring tower, used nowhere else in the world, has proved that available coal reserves of at least 300 million long tons exist 2,000 ft below the North Sea, between Hartlepools and the Tyne, reported Lord Robens, NCB chairman. If the reserves can be mined efficiently, an electric-generating station capable of consuming 5 million long tons a year for at least 20 yr could be sited on the coalfield, he added. The Durham Division Coal Board is studying the economic feasibility of the project.

Essential



to Modern Mining Practice

STAMLER EQUIPMENT coordinates fast loading with fast automatic mining.

The Stamler CAR SPOTTER — famous since 1949 — *breaks costly loading point bottlenecks . . .* will move your coal faster, more efficiently *and at LESS COST than any other method.* Attempts have been made to IMITATE IT — *but no one has come close to EQUALLING it* — because no one can DUPLICATE its patented features.

The Stamler TILT PAN automatically loads an entire trip without belt stoppage or spillage between cars. *It operates perfectly with non-uniform car lengths.* It permits the use of the boom man on productive face jobs . . . and gives uniform loading without an attendant to "push the button". The Stamler Tilt Pan is quickly installed and easily moved. *No hydraulic power source is required;* the cars themselves operate tilt pan at the exact proper moment.

Wherever STAMLER equipment is operating there is a marked speed-up in moving coal and a corresponding decrease in loading costs. Let us show you what STAMLER equipment can do to lower YOUR loading costs.

STAMLER *Automatic* TILT PANS

STAMLER *Hydraulic* CAR SPOTTERS

SCHROEDER BROTHERS, Exclusive Eastern Sales Agent
Pittsburgh, Pennsylvania
UNION INDUSTRIAL CORP., Carlsbad, New Mexico

W. R. STAMLER CORPORATION

PARIS, KENTUCKY

SALMON & CO., Birmingham, Alabama
WESTERN SALES ENGINEERING CO., Salt Lake City, Utah

Coming Meetings

National Safety Congress, Oct. 16-20, 1961—Conrad-Hilton Hotel, Chicago, Ill.

Illinois Mining Institute, Oct. 20, 1961 — Hotel Abraham Lincoln, Springfield, Ill.

West Virginia Coal Mining Institute, Central Appalachian Section, AIME, Nov. 3-4, 1961 — Greenbrier Hotel, White Sulphur Springs, W. Va.

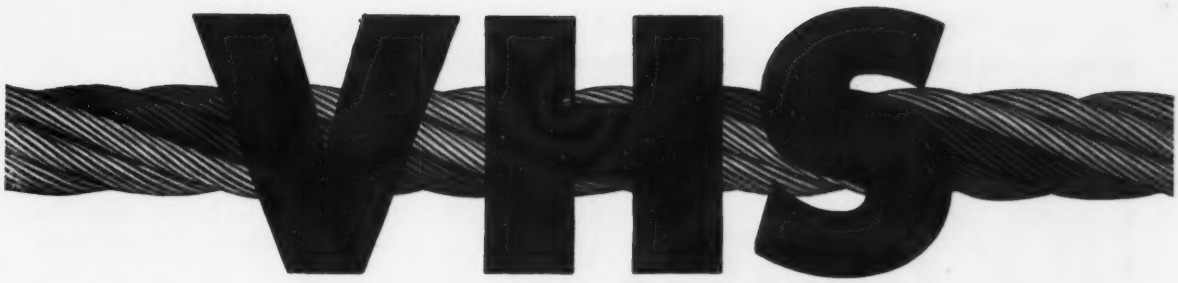
Kentucky Mining Institute, Nov. 9-10, 1961—Phoenix Hotel, Lexington, Ky.

Coal Division Conference, American Mining Congress, Nov. 17, 1961 —Penn-Sheraton Hotel, Pittsburgh, Pa.

Coal Mining Institute of America, 75th Annual Meeting, Dec. 14-15, 1961 — Penn-Sheraton Hotel, Pittsburgh, Pa.

AIME Annual Meeting, Feb. 18-22, 1962 — Statler-Hilton Hotel, New York, N. Y.

1962 Coal Convention, American Mining Congress, May 6-9, 1962—Pittsburgh, Pa.



Two Green Strands or One...

either guarantees you Genuine American Cable Quality

One green strand identifies American Cable Preformed IPS (improved plow steel) —the long-wearing, general-purpose rope made by the originators of preformed rope. Two green strands identify American Cable VHS—the first new grade of rope ever developed for Very High Strength applications. Two simple identifying symbols. Yet both are of utmost importance when you buy wire rope. American Cable's green strand identification is your assurance that you are getting the rope you ordered. It's your guarantee of made-by-American quality in every foot. And it's our promise that the rope will perform the way we say it will.

So when you order American Cable rope—whether it's double green strand VHS or single green strand IPS—be sure you get what you ask for. Remember, there are no substitutes!

ACCO

TRADE MARK

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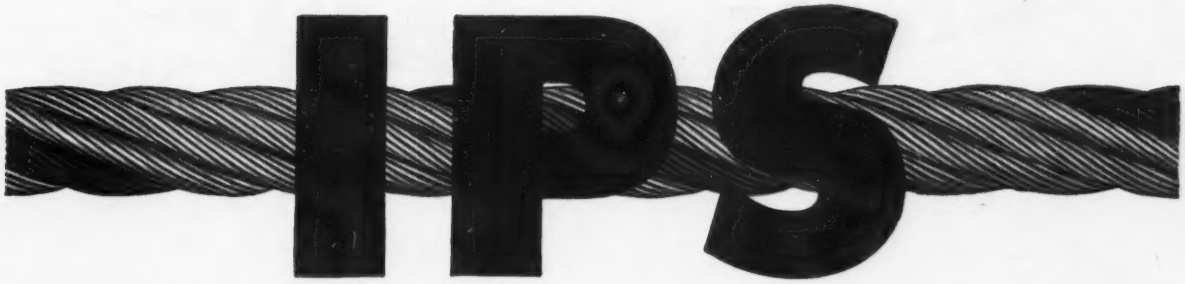
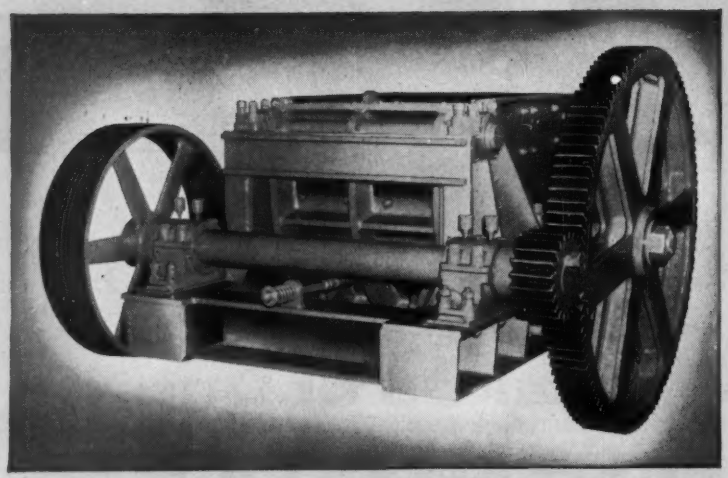
American Chain & Cable Company, Inc.

Sales Offices: Wilkes-Barre, Pa., Atlanta, Chicago (Melrose Park), Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.





CRUSHING MINE REFUSE? Pennsylvania HERCULES can lower costs for crushing hard rock, slate, other refuse

Pennsylvania has researched the factors that make single roll crushing costs mount—and offers a machine specifically designed, and *job-proved*, to keep costs down.

Cast alloy steel roll shell is made in one piece and keyed as well as shrunk on the rollshaft. No segments or renewable teeth to loosen or fall out. Readily accessible teeth are easily built up by welding.

Here are just a few high spots of this great crusher:

- Hopper jams are prevented by the larger hopper opening and spacious throat opening made possible by the contour of the breaker plate.

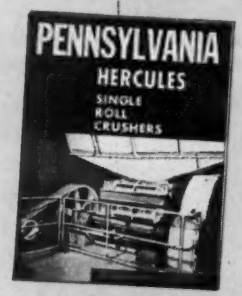
New automatic toggle release supplies positive release mechanism for breaker plate.

New design of countershaft placement, plus large diameter of the gear improve stress distribution on countershaft bearings.

Hercules bearings are away from the frame. Easy to get at, easy to maintain.

Breaker plate is heavy steel fabrication lined with cast manganese steel wearing plates; guaranteed against cracks and flaws.

If you have a job where a single roll might be used, find out more how this Pennsylvania Hercules will save you money in more ways than one. Send for new Bulletin 2020.

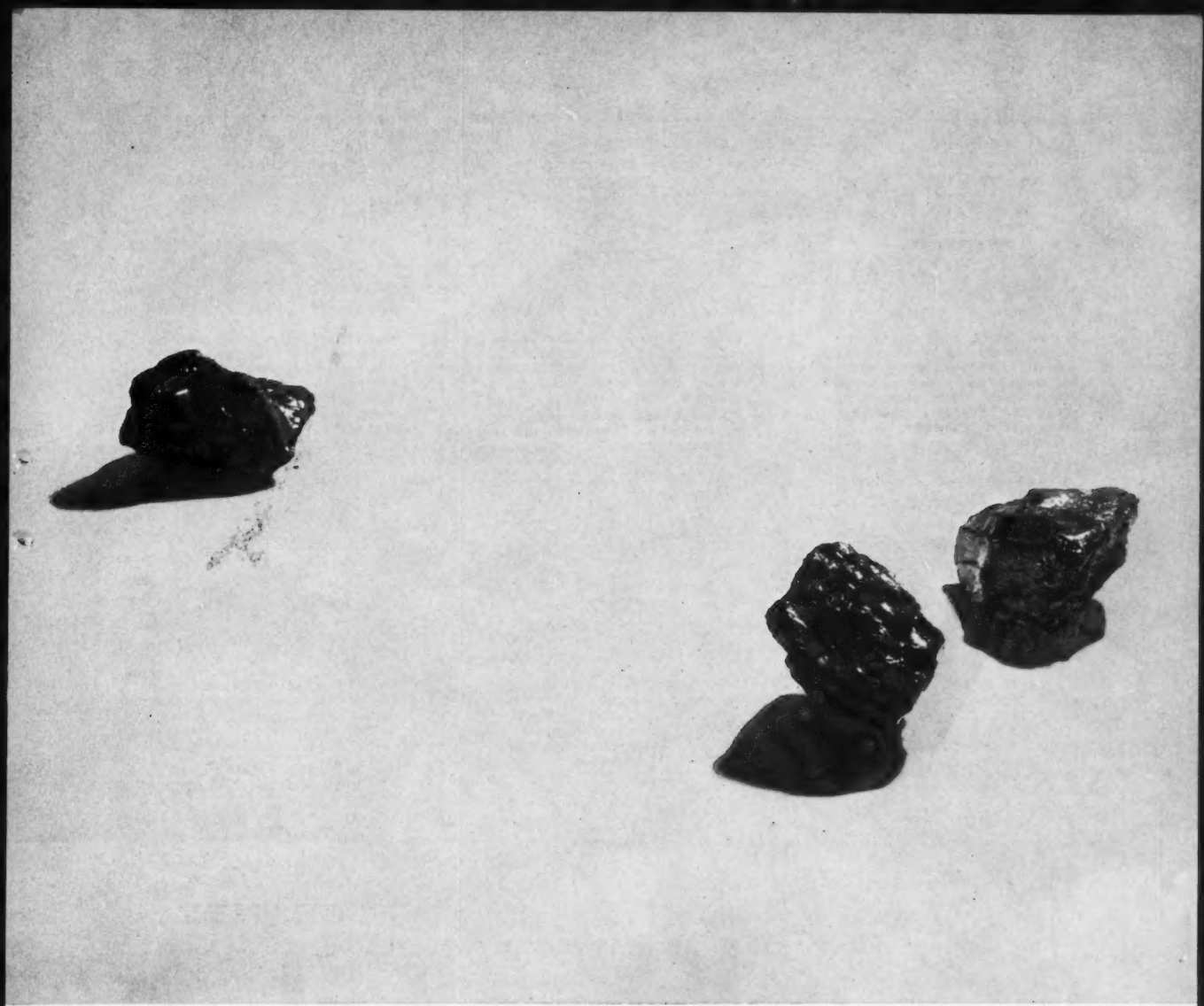


PENNSYLVANIA CRUSHER DIVISION
BATH IRON WORKS CORPORATION
WEST CHESTER, PENNA.

★ ★ ★

Over 50 years concentrated experience in all types of material reduction makes Pennsylvania your best source of crushers and engineering advice and service. Call on Pennsylvania with your next crushing problem. Representatives from coast-to-coast.

PENNSYLVANIA
BATH-BUILT
CRUSHERS

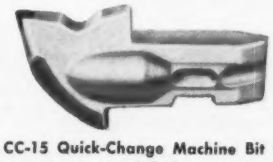


One lump...or two?

Well, when it comes to mining bits, the greater the output-per-bit, the better. And with quality Carboloy® machine bits, output-per-bit *is* greater (and the cost-per-ton lower), because the bits are built to last longer.

How?

Because quality Carboloy mining bits are just the right combination of cemented carbide, heavy-duty shanks, and super-strong brazes. This results in a bit that's built to "bite" better . . . a bit that lasts a lot longer.



The CC-15 Quick-Change Machine Bit gives more tonnage per shift because less time is required for bit changing.

So, if you want two "lumps" instead of one, give Carboloy mining bits a try. See for yourself how quality pays a big dividend. Your Authorized Carboloy Mining Tool Distributor and our local engineer will give you all the information and assistance you need. Or, if you prefer, write: *Metallurgical Products Department of General Electric Company, 11120 E. 8 Mile Ave., Detroit 32, Michigan.*

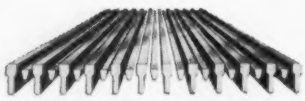
CARBOLOY
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMOND • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

T-WEDGE KLEENSLOT



A new concept in guard bar design. T-shaped wire replaces typical "bar" to increase screening surface while keeping large unscreenable lumps of material above the tolerance governing lower screening surface.

F217 and F250
KLEENSLOT

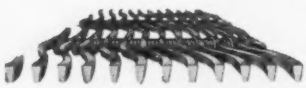
Manufactured with large size wedge shaped wires to maintain maximum efficiency over an extended period in abrasive applications.

Although large in wire size, this screen will easily maintain openings as close as 1 m.m.

G187 and GB187
MIGH-TEE KLEENSLOT

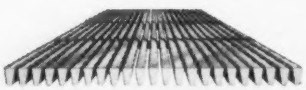
Special profile increases wearing surface. This is a heavy duty precision type screen that will easily maintain openings smaller than ⅛ m.m. and openings larger than ordinarily considered economical.

"S" KLEENSLOT



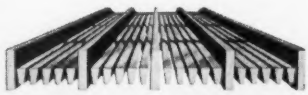
Engineered for applications where screening out of flats or slivers is of prime consideration. Can be also furnished in a "C" bend. Recommended for applications requiring openings larger than 1 m.m. For smaller openings, see Marcel screen.

MARCEL

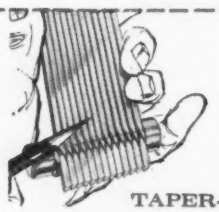


This screen, while screening out "slivers," presents a flat surface for materials to wipe the opening clean. Available with openings up to 1 m.m.—for larger openings see "S" screens.

SCREEN GUARD



Vertical guard bars keep larger unscreenable materials above the actual screening surface. This increases screen life and promotes much greater efficiency in dewatering.



TAPER-SLOT

From loop to loop, the screen opening gradually increases. This design is to eliminate blinding when screening large amounts of near-opening size materials.

For example: .016 opening tapered to .024—the combination of opening sizes would be the same between each loop throughout the entire screen.

WEDGE-WIRE

Kleenslot

REG. U. S. PAT. OFF.

PREPARATION SCREENS

designed for vibrators or stationary applications for dewatering, screening, washing, extracting, filtering or sizing applications.

Wedge-Wire Kleenslot Screens are custom manufactured to your application and are available in many sizes, metals and finishes. Our engineering staff will assist you capably and promptly in obtaining the proper screen for highest production at lowest cost.

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SCREENS FOR INDUSTRY

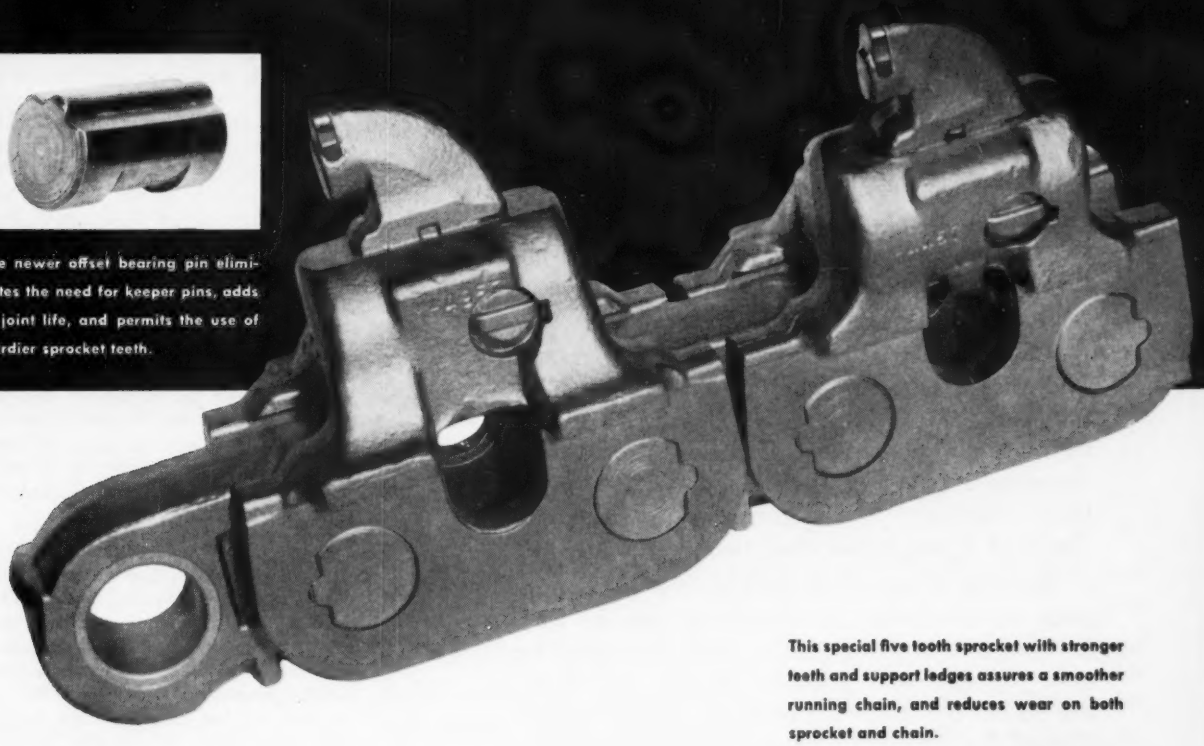
WEDGE-WIRE CORPORATION
Wellington, Ohio

send for our free catalog

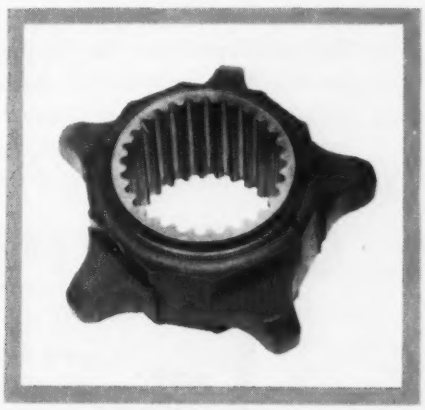
Cincinnati SHORT PITCH
HEAVY DUTY RIPPER CHAIN—
FOR RIPPER TYPE MINERS

Available in either Rap-Lok or Set Screw design

The newer offset bearing pin eliminates the need for keeper pins, adds to joint life, and permits the use of sturdier sprocket teeth.



This special five tooth sprocket with stronger teeth and support ledges assures a smoother running chain, and reduces wear on both sprocket and chain.



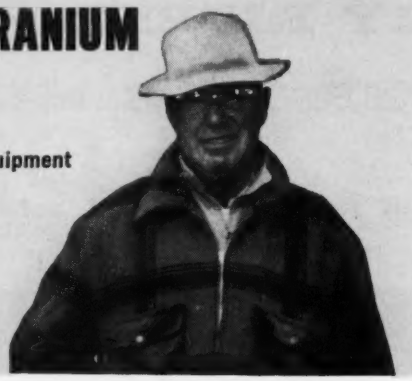
The CINCINNATI SHORT PITCH CHAIN makes it possible to utilize bearing pin of maximum diameter without sacrificing sprocket tooth space strength of pin or block—or diminishing any wearing surfaces. CONTINUOUS MINER incorporates all the features that have made Cincinnati cutter chains world famous.

®C

THE CINCINNATI MINE MACHINERY CO. CINCINNATI 25, OHI

FROM CONSTRUCTION WORK TO URANIUM MINING

"Bonded Buy used Cat equipment has always given me first-rate service," says GARN MOODY



Garn Moody has capitalized on his working knowledge of heavy equipment to branch out into a number of successful business operations. From his initial start in contracting, he has put his reliable spread of used Cat-built equipment to work in the non-allied fields of farming and, since late 1958, a thriving strip-mining operation in the rugged country near Delta, Utah.

"When you're moving into an unfamiliar new field, you've got to have smart crews and dependable equipment," says Garn Moody. "My used Cat-built rigs have always given me good steady production. We've worked our two D8s and two DW20s 8 to 10 hours a day since we bought them two years ago. The work is rough, but down time has been light."

Garn has purchased all three types of used equipment his Caterpillar Dealer offers: Bonded Buy, Certified Buy and Buy and Try. "In each case," he says, "the deal worked out fine for me. I'll buy under the same contracts any time. Dependability from Bonded Buy machines is like buying a new machine."

Success is never a sure thing, but if you're expanding your operations and trying to keep your equipment outlay on a budget basis—without sacrificing reliability—check your Caterpillar Dealer's protected purchase plans.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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BEST BUYS IN NEW AND USED EQUIPMENT

Current Coal Patents

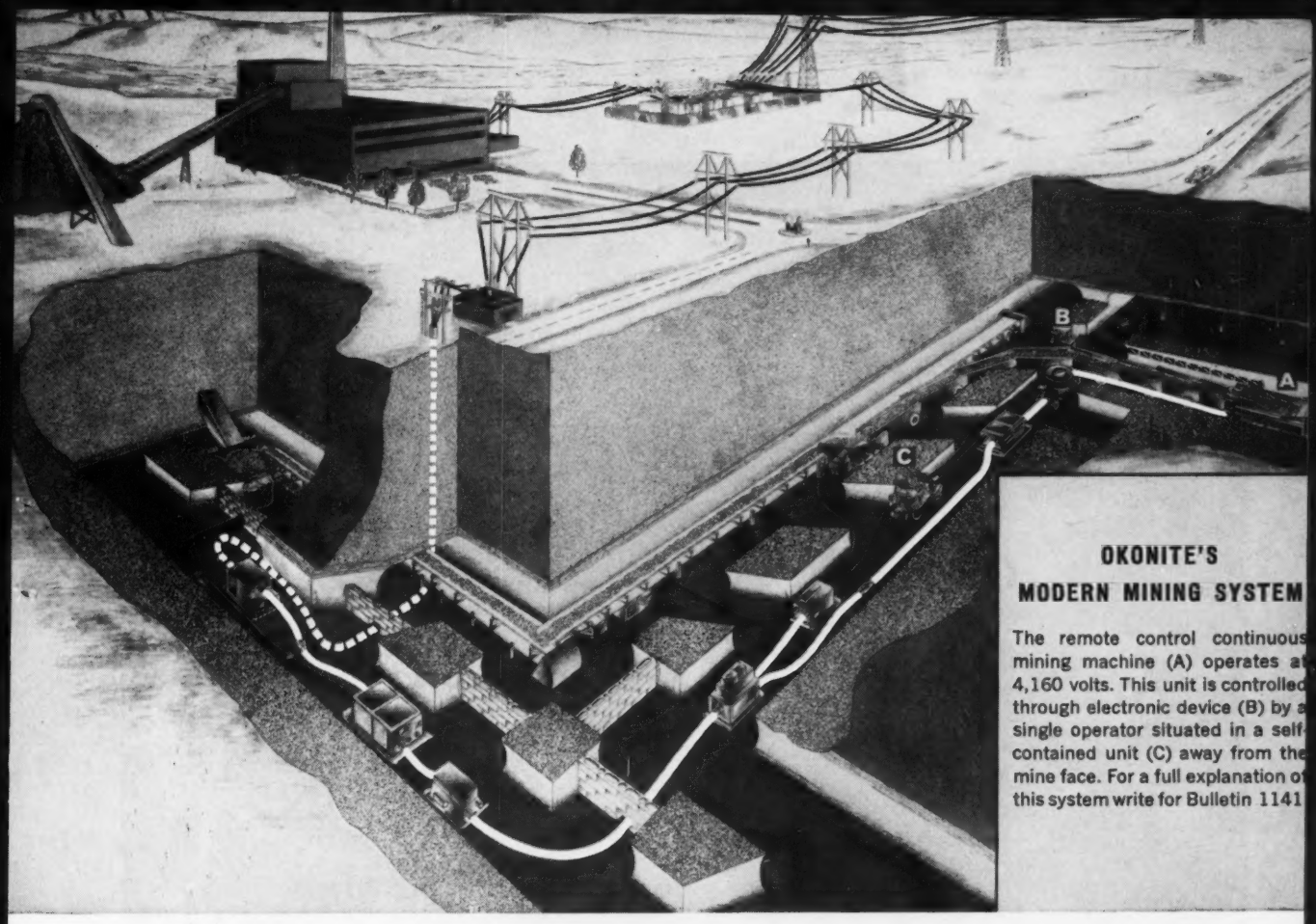
Oliver S. North
Patent Research and Abstracting
Arlington, Va.

Process and apparatus for wet screening, F. J. Fontein (assigned to Stamicarbon N.V., Heerlen, Netherlands), Aug. 15, 1961. In the sieve bend screening of slurries of coal or other solids, a method is provided for eliminating the high feed drop and thereby reducing the total height of the installation. A hydroclone vortex rotating around an axis parallel to the generatrices of a screening deck is fed, as a layer or in the form of a plurality of suspension jets, tangentially to the concave side of the screening deck, in a direction perpendicular to the generatrices of this deck and substantially tangential to the body of the feed suspension, at a velocity at least equalling the tangential velocity of the outer layer. The kinetic energy of discharge of the hydroclone is used as the feed energy for the sieve bend. No. 2,996,182.

Coal breaking, sizing and stone separating apparatus, R. Stafford and K. Damron, Aug. 15, 1961. Design for a coal sizing and breaking apparatus which is comparatively low in cost and easy to operate and maintain. The coal is broken and separated from the rock without breaking the rock. Breaking is accomplished by a series of chains mounted on a rotary member. No. 2,996,259.

Frame jibs for coal cutting machines, S. E. Proctor (assigned to Austin Hoy & Co., Ltd., High Wycombe, England), Aug. 29, 1961. Design for an improved mining-machine frame jib wherein the intermediate side portions comprise two portions hinged to one another and to the top and bottom half of the frame. This frame jib can be collapsed by relative movement of the top and bottom arms. The intermediate side portion has no gap when it is straightened for use in cutting coal. No. 2,998,235.

Blending hopper for minimizing segregation when reclaiming granular materials such as coal from storage. Assigned to Templeton-Matthews Corp., Terre Haute, Ind., Aug., 1961. Consists of an auxiliary bottom added to the conventional bin or hopper bottom. The slope of the conical auxiliary bottom is less than the slope of the main hopper bottom, thus providing a self-relieving action. Ribs holds the auxiliary bottom the desired distance away from the main hopper bottom. As a result of the design, the blender retards the removal of the fine core material and draws from various zones over the entire cross-section of the storage area. No. 2,994,460.



OKONITE'S MODERN MINING SYSTEM

The remote control continuous mining machine (A) operates at 4,160 volts. This unit is controlled through electronic device (B) by a single operator situated in a self-contained unit (C) away from the mine face. For a full explanation of this system write for Bulletin 1141

HIGH VOLTAGE MINING—

A new approach to increased production and reduced cost

There's one thing we know about modern mining . . . to improve the industry's competitive position it must be more productive at lower operating cost. What you see illustrated here is a realistic approach to this problem as visualized by Okonite engineers.

A continuous, automated system, this "Modern Mine" depends on a high voltage system right to the mine face. This, in turn, depends upon specially designed cables for each function. Supplying these cables is no problem for Okonite . . . Okonite has been pioneering in Cable'bility* since 1878.

Helping to further the role of electricity in mining operations has always been an Okonite aim. It is hoped that this illustration of tomorrow's mine may stimulate your interest. Our representative will be glad to fully discuss the thinking behind this system with you. Whether you are designing your own modern mining system or redesigning your present system, you can rely on one thing—Okonite has the cable that can add power to your imagination. For the complete story on "Okonite's modern mining system" write for Bulletin 1141, The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, New Jersey.

*Cable'bility . . . cable craftsmanship since 1878

where there's electrical power . . . there's **OKONITE CABLE**

8428

Machine pictured is a Jeffrey COLMOL

A breakdown here could cost 1.25 tons per minute

A Texaco "Stop Loss" Program can keep it from happening in your mine.

A Texaco "Stop Loss" Program can lengthen equipment life by uncovering lubrication problem areas and recommending solutions—*before* the equipment breaks down. The program will also raise tons-per-man rates by extending intervals between overhauls. It may even help you slash over-all maintenance costs by as much as 10 per cent.

How Texaco's Program works: Texaco's "Stop Loss" Program is primarily concerned with getting the right lubricants into the right place at the right time. It involves a study of your requirements, an analysis of your special problems . . . finally, the selection of the proper lubricants and the training of your personnel in their application. *And it produces results.*

Ask your local Texaco Representative to prove what a "Stop Loss" Program can do for you. Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

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Monday through Friday—NBC-TV

TEXACO

TEXACO

Throughout the United States
Canada • Latin America • West Africa

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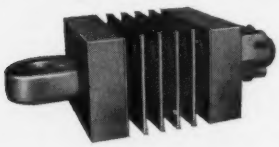
WILLISON AUTOMATIC COUPLERS



NATIONAL CUSHIONING DEVICES

NACO CAST STEEL WHEELS

for new welded aluminum mine cars

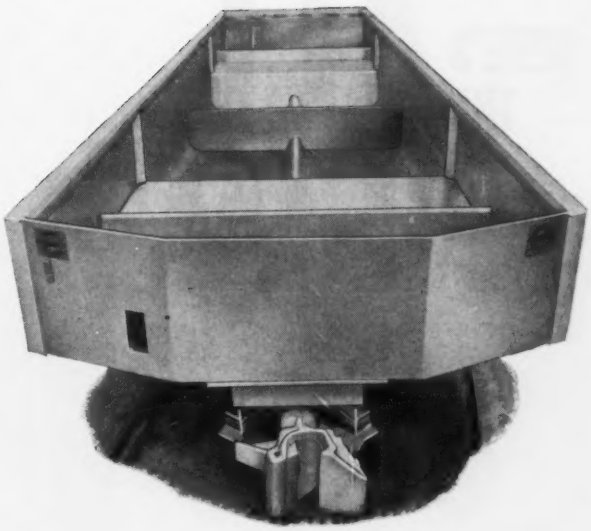


Photo: Courtesy Irwin-Sensenich Corporation, Irwin, Pa.

The new welded-aluminum 8-wheel cars being built by Irwin for one of the country's largest coal mines are the last word in modern rotary dump car design for faster, safer, more efficient haulage. And to keep them operating faster . . . safer . . . *years longer*, they are equipped with National mine car specialties:

Willison Couplers — Extremely wide gathering range . . . couple automatically . . . no need to go between cars to uncouple.

National Cushioning Devices — MI-230-5 longitudinal rubber cushioning devices absorb end-to-end impacts for extended equipment life at higher speeds.

Naco Cast Steel Wheels — High yield point electric furnace steel gives exceptional tensile strength and ductility to whip premature tread spalling and flange breakage.

King Pin Castings — Special high tensile steel ball bearing king pin castings give utmost strength . . . resist abrasion even under roughest service.

For new cars — or for equipment upgrading programs — *look into National mine car specialties for maximum speed, safety, tonnage, life.*

Mine Sales • Transportation Products Division

DESIGN WITH STEEL CASTINGS Centennial 1861-1961 STRENGTH IN SHAPE

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ALL-HYDRAULIC
crawler-mounted
C-350
REICHdrill

NOMINAL HOLE SIZE — 2-4"
DOWN-PRESSURE — 10,000 lbs.
ROTARY SPEED — 0-200 rpm.

Versatile — prospects with diamond core bits or wire line tools . . . drills blastholes with 3-cone rotary bits or In-Hole Drills.

Maneuverable — can climb a 25% grade, turn in its own length . . . tram at almost 8 mph!

Stable — 14" wide tracks . . . exceptionally low center of gravity . . . 8' 8" wide frame, meet and beat any terrain.

Operator convenience — Control Console places every control at operator's fingertips . . . every movement within sight . . . *and* hydraulics do all the work — give infinite combinations of feed pressure and rotational speeds.

REICHdrill
FRANKLIN (VENANGO COUNTY), PENNA.
Division: CHICAGO PNEUMATIC TOOL CO.

People in Coal

(*Continued from p 41*)

assistant mining engineer, Dominion Coal Co., Ltd., Sydney; secretary-treasurer—Sydney C. Mifflen, technical assistant to general manager, Dominion Coal Co., Ltd.; and assistant secretary—Ronald F. MacKinnon, chief mine surveyor, Dominion Coal Co., Ltd., Sydney.

In addition, these councillors were chosen: E. D. Brown, vice president, National Gypsum (Canada) Ltd., Dartmount; D. G. Burchell, managing-director, Bras d'Or Coal Co., Little Bras d'Or; E. L. Cameron, professor of mining engineering, Nova Scotia Technical College, Halifax; Frank Doxey, general manager—coal operations, Dominion Steel & Coal Corp., Ltd., Sydney; M. G. Goudge, director, Engineering Div., Dept. of Mines, Halifax; D. O. Hartigan, president, Indian Cove Coal Co., Ltd., Sydney Mines; J. J. Laffin, chief electrical engineer, Dominion Coal Co., Ltd., Sydney; Angus MacDonald, district superintendent, Dominion Coal Co., Ltd., Sydney; E. S. MacLean, mechanical superintendent, Dominion Coal Co., Ltd., Glace Bay; D. M. MacMillan, sales engineer, Foulis Engineering Sales Ltd., Halifax; H. A. Marshall, manager, industrial sales, Imperial Oil Ltd., Halifax; C. N. Murray, general manager, Dominion Steel & Coal Corp., Ltd., Sydney; S. G. Naish, district manager, Joy Mfg. Co. of Canada, Ltd., Sydney; J. E. Terry, shops manager, Dominion Coal Co., Ltd., Glace Bay; and J. A. Turner, comptroller, Mining Div., Dominion Steel & Coal Corp., Ltd., Sydney.

Three councillors, ex-officio elected are H. C. M. Gordon, honorary president, Sydney; Louis Frost, immediate past-president, Sydney; and Dr. J. P. Nowlan, deputy minister of mines, Halifax.

Bituminous Output

YEAR TO DATE	PRODUCTION
Sept. 16, 1961	268,662,000
Sept. 17, 1960	296,878,000

1961 output 9.5% behind 1960.

WEEK ENDING	PRODUCTION
Sept. 16, 1961	8,770,000
Sept. 17, 1960	8,328,000

Anthracite Output

YEAR TO DATE	PRODUCTION
Sept. 16, 1961	12,575,000
Sept. 17, 1960	12,887,000

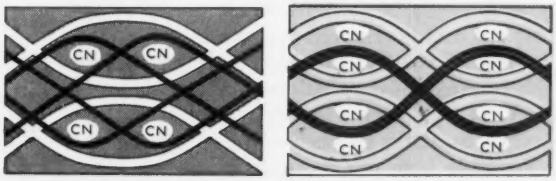
1961 output 2.4% behind 1960.

WEEK ENDING	PRODUCTION
Sept. 16, 1961	373,000
Sept. 17, 1960	383,000

NEW ROYAL GOLD BURRO BELTING

Built better to last longer

When all the facts are in, it's clear that no other interwoven belting can match U.S. Royal Gold Burro. This new belting has not only been made highly fire resistant without sacrificing strength, but its high-visibility gold cover insures maximum safety in dimly lit underground areas.



While inferior belts (left) have only one base layer to protect tension members after the PVC layer is worn through, the Royal Gold Burro (right) has an extra layer of cotton-nylon fillers to give added protection to the tension members—longer life to the belt. Note central placement of nylon tension members for maximum pulling strength.

And unlike other belting, whose strength members are covered by only one layer of base yarn, the yarn-dipped, all-PVC Royal Gold Burro has an extra layer of cotton-nylon fillers beneath its tough cover to give maximum protection to its extremely high-strength nylon tension members.

Extra strands of filament nylon on the belt's edges provide greater rip and tear resistance, add to Royal Gold Burro's excellent troughability and training characteristics.

Low-cost Royal Gold Burro Belting is available in standard widths and in lengths to 1,200 ft. For further information and on-the-spot assistance, call your nearest US Distributor.

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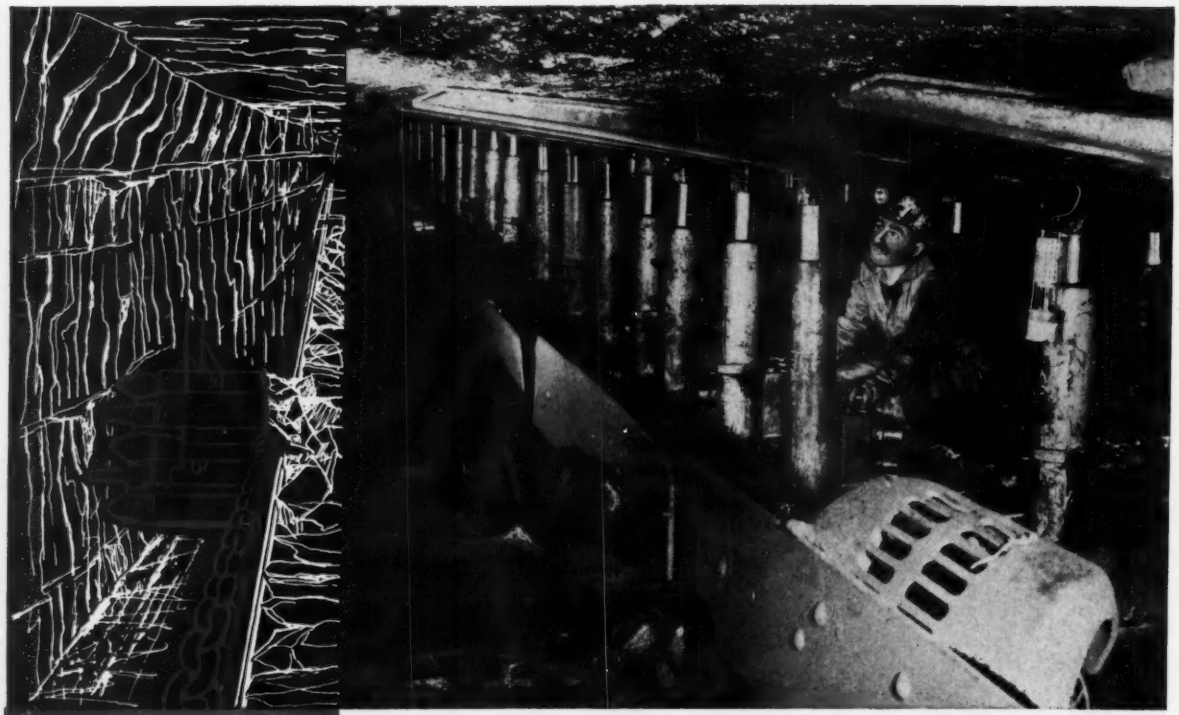

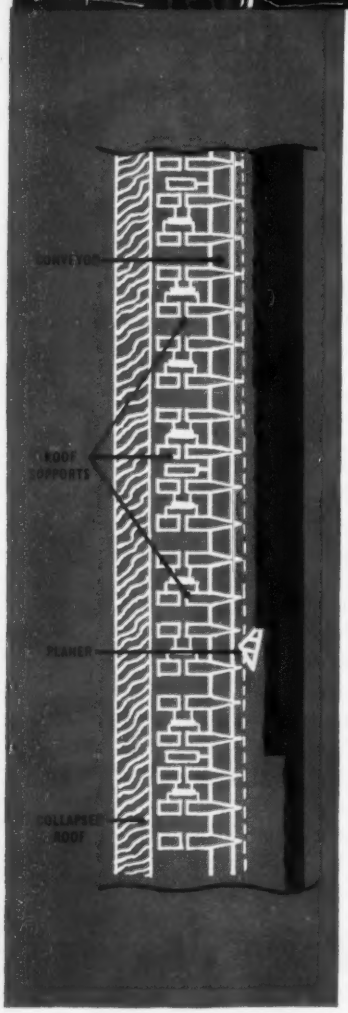

Westfalia Coal Planer Scores U.S. Success

During a full year's operation in a West Virginia mine, the Westfalia Coal Planer has demonstrated its ability to give high average tons-per-man production, low maintenance and dependable roof control. Operating in a mine with a 52-inch seam, the Westfalia Coal Planer is giving truly continuous mining along a 600-foot face. You cut production costs with the durable Westfalia long wall mining system because maintenance and repair expenses go down. You need no other roof supports or bolting. Cutting, drilling, explosives and other loading equipment are eliminated. Here is the only truly continuous mining method. It is the only successful, proven way to extract all the coal across working faces extending up to 800 feet—or even more. In thick or thin seams, the new Westfalia self-advancing, hydraulic roof supports, conveyor and planer all press continually against the face with a minimum of open area. Burnt or sticking top coal is removed automatically by the planer. Westfalia has proved itself in all major coal producing areas of the world with hundreds of installations. Now, continuous two-shift operation in West Virginia proves the Westfalia system to American operators. Consultation on engineering or equipment problems is readily available from our technical personnel with no obligation.

Mining Progress, Inc.

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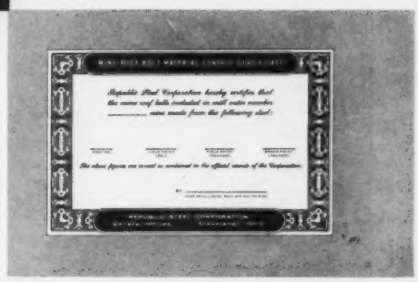

REGARDING A RESPONSIBILITY

A safe roof means safe workers, and a roof is only as safe as the reliability of its support. Lives depend on this. That is why the quality and strength of every roof bolt is a vital responsibility of the manufacturer.

Republic accepted this responsibility many years ago by certifying *in writing* the exact quality and strength of every mine roof bolt delivered to a customer. Such certification still accompanies every shipment. This "certified performance" document is our pledge to mine operators, and to the men at the working face.

It is our further pledge to cooperate fully with Coal in the challenging New Growth Era to come, with products made with the same integrity. Republic is proud to have shared in the remarkable advancements of mining in past decades—and anticipates an even more exciting future.

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U. S. STEEL'S GARY DISTRICT BECAME A MEMBER OF THE AMERICAN TREE FARM SYSTEM Sept. 15, receiving a Certificate of Membership for its continuing interest in forest conservation. C. W. Connor Jr. (center), Gary District's general superintendent, received a tree farm sign from C. R. Sullivan (left), West Virginia Tree Farm Committee. Dr. Warden C. Lane (right), director, West Virginia Department of Natural Resources, was the principal speaker. Over 150 attended the ceremonies held at the Sandlick Sportsmen's Club on No. 9 Mountain, Gary, W. Va.

An important aspect of this district's timbering plan was the formation of a modern forest inventory system establishing an up-to-date method of effecting a perpetual forest management program.

(*Continued from p 28*)

where full interconnection and pooling of the output of both private and public generating plants will serve the national interest."

S. Illinois Industrial Boom Seen If Canal OK'd

An industrial boom that would bring an estimated $1 billion in new industry to depressed southern Illinois is anticipated if the proposed Kaskaskia River Canal project is approved by Congress as expected.

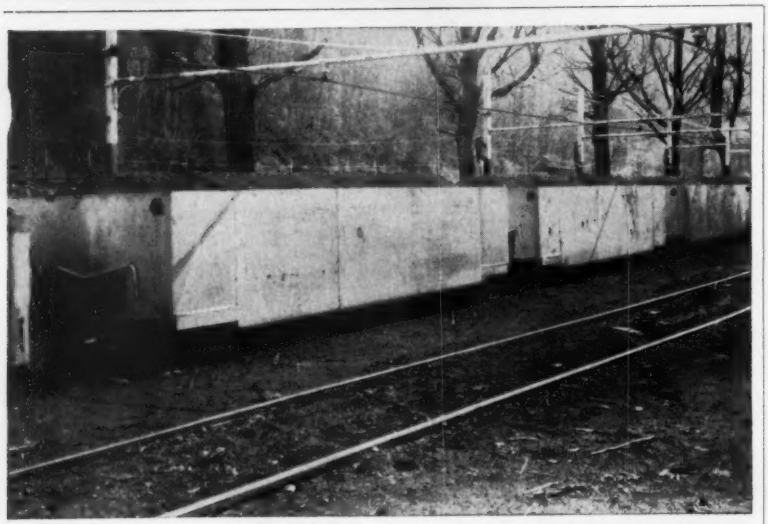
The opening of river transportation to the Kaskaskia Valley would permit economic development of an estimated 2 billion tons of coal reserves heretofore considered impracticable to mine. And already over 2,000 acres each have been purchased by the Kaiser Aluminum & Chemical Corp. for a proposed aluminum reduction plant and the Illinois Power Co. which says it will definitely build a 1-million-kw power plant near Baldwin, Ill. These two plants will cost an estimated $230 million. It has also been reported that at least six other major industrial companies are taking options on huge acreage along the proposed 55 mi navigation route.

Senator Dirksen (R-Ill.) has introduced in Congress the bill authorizing an expenditure of $60 million on the Kaskaskia project. Of this amount about $58 million would be supplied by the federal government. It has already won approval of the Army Board of Engineers for rivers and harbors, and has the strong approval of Congressional leaders from Missouri and Illinois.

To be 9 ft deep and 200 ft wide, the proposed canal would be capable of handling 20 million tons of waterborne commerce annually, and would run from the mouth of the Kaskaskia River at Chester to Fayetteville, Ill.

UMW Seeks Suit Dismissal

The United Mine Workers of America have asked dismissal of a $30-million antitrust suit accusing the union of promoting western Kentucky coal at the



haulage capacity...

Place Pocahontas Field

Operator Name on request

Car Dimensions Length: 21′ 6″ (body)
Width: 7′
Height: 48″ (above rails)
Weight: 8600 lbs. (empty)

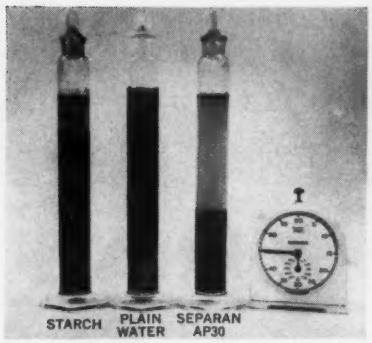
Capacity 500 cu. ft. (level load)
585 cu. ft. (crown load)

where can you match it?

Since 1915 — Pioneers in haulage equipment

DIFFERENTIAL STEEL CAR COMPANY
FINDLAY, OHIO

get fast flocculation of coal fines at low cost



This illustration compares the effectiveness of Separan® AP30 in the settling of coal fines in water, as compared to starch and plain water. Notice that, in the cylinder containing Separan AP30, settling is nearly complete after only 45 seconds.

In actual plant use, Separan AP30 is producing settling rates of 20 to 25 feet per hour at concentrations of 0.01 to 0.20 pounds per ton of solids.

Many plant operators report that the cost of using Separan AP30 has often been only half the cost of flocculants previously used. Costs of only 1½¢ to 3¢ per ton of solids have been recorded.

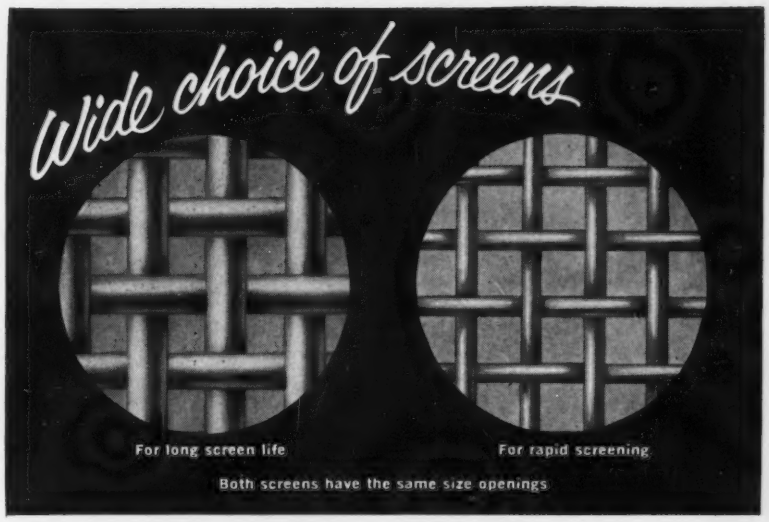
Also, with Separan AP30, many operators have been able to maintain clear wash-water overflow at high plant rates without adding expensive new equipment—thereby keeping down capital investment.

Arrange for a demonstration of Separan AP30 at your plant. Contact Dowell at 1918 Highway 41 North, Evansville 7, Indiana; telephone HArrison 5-1353. Or, contact B. E. Scott at 197 Monterey Drive, St. Albans, West Virginia; telephone PArkway 7-2895.

PRODUCTS FOR THE COAL INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY



Different operations make varying demands on vibrating screens: extreme accuracy in sizing . . . reduced clogging of material . . . long screen life . . . or fast screening. There's a CF&I Screen designed to satisfy *any* of these conditions — you can take your choice of many different wire sizes and screen openings. This means you get exactly the screen you need — giving you more efficient screening, fewer replacement screens, greater profits.

CF&I Space Screens are made from a special, long-lasting alloy steel wire, and *precision woven* to remain tight and rigid throughout their long life. You can choose from a variety of weaves, crimps and edge preparations. For full details about CF&I Space Screens, send for catalog MS 661 Rev.

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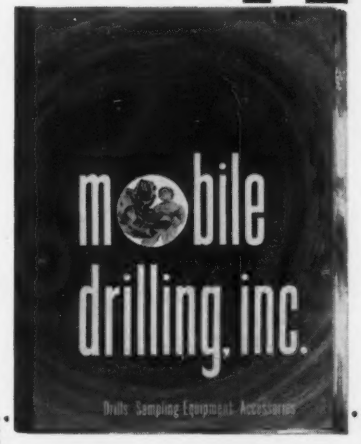

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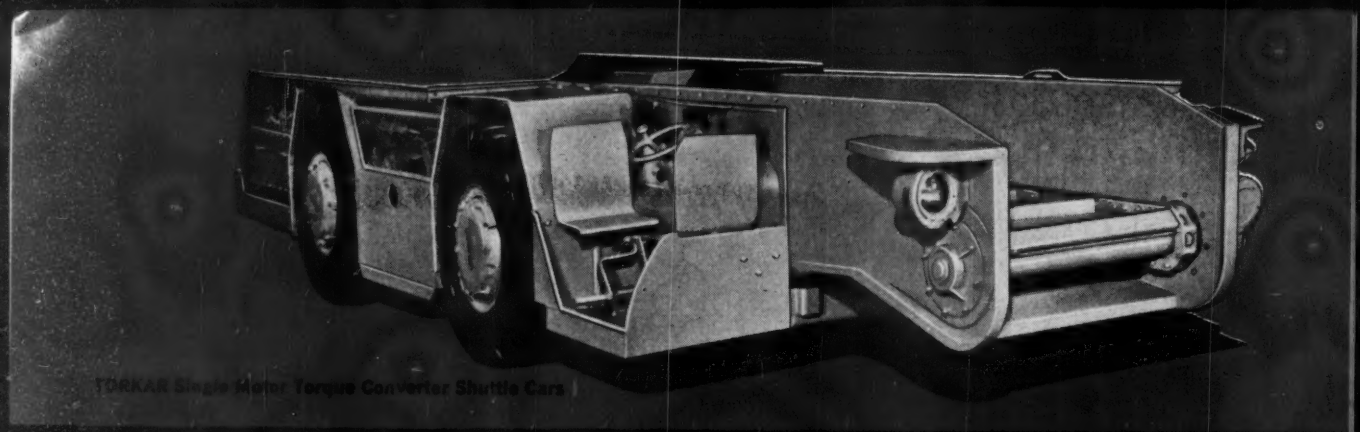
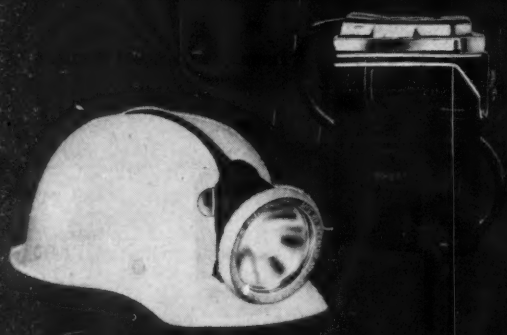
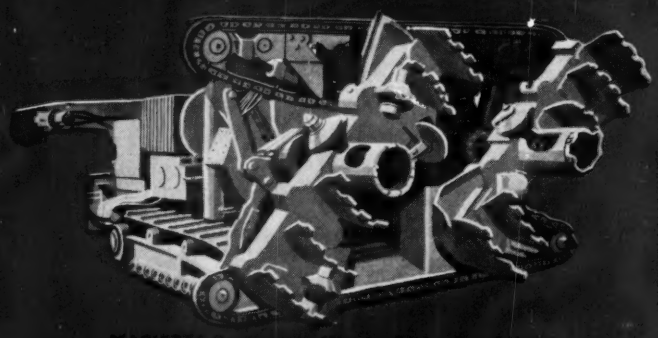


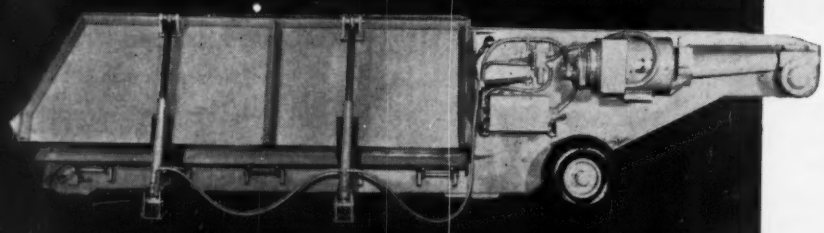
TORKAR Single Motor Torque Converter Shuttle Cars



CLARKSON REDBIRD Conveyor Chain

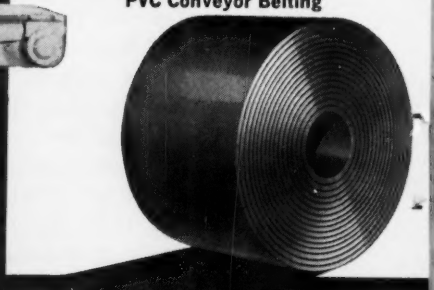


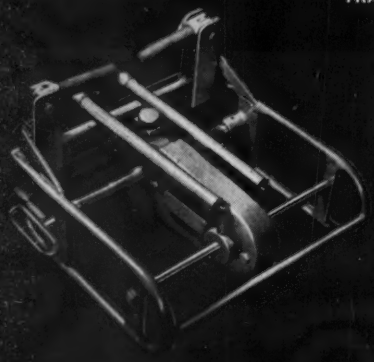
MARIETTA Continuous Miner Gathering Head



TRANSFEEDER Belt and Car Feeders

SCANDURA Original Solid Woven PVC Conveyor Belting





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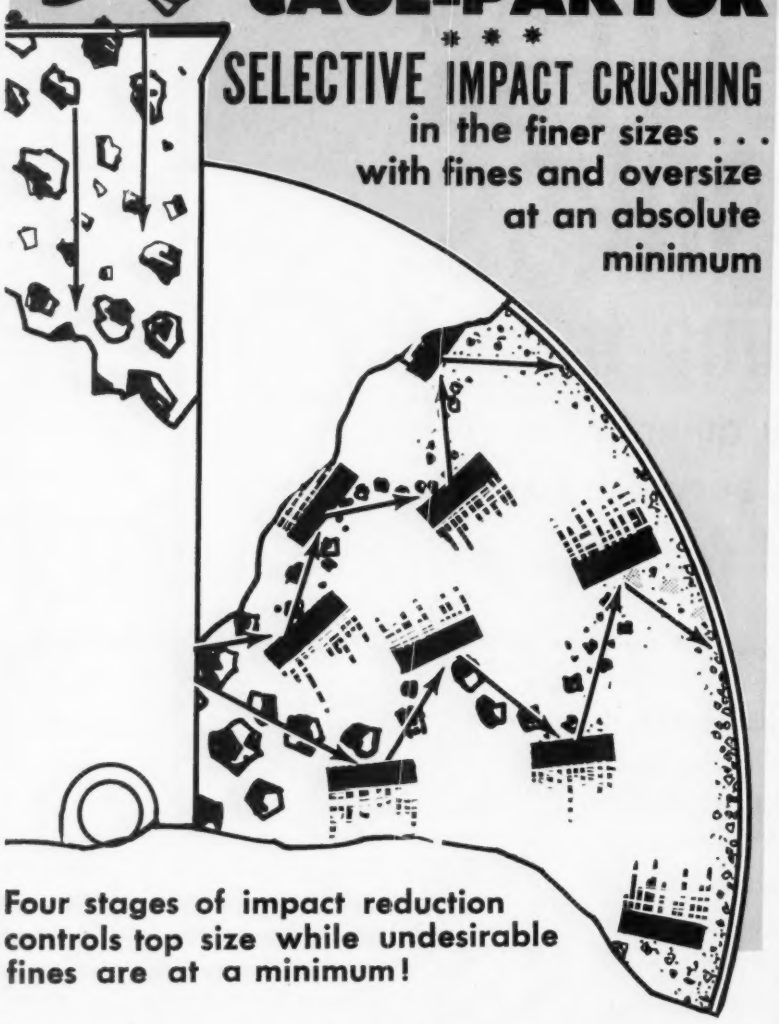
in the finer sizes . . . with fines and oversize at an absolute minimum



Four stages of impact reduction controls top size while undesirable fines are at a minimum!

The Proof is in the Results . . .

Our complete testing facilities are at your service without obligation.

Typical Applications: Cyclone Boiler Feed . . . Coal Sampling . . . Middlings . . . Coal Pipeline Feed . . . Sinter Plants . . . Calcined and Green Petroleum Coke . . . Coal Feeds for Coke Ovens (Blast Furnace and Bee Hive).

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Division of J. M. J. Industries

expense of southeastern Tennessee.

The suit (*Coal Age*, Aug. 1961, p 26) brought in U. S. District Court by 16 small coal mine operators from the Chattanooga, Tenn., area under the Sherman Antitrust Act, accuses the UMW of financing the mechanization of coal mines in western Kentucky. This, the suit claims, placed southeast Tennessee at a competitive disadvantage, particularly as regards the sale of coal to TVA, the nation's largest coal buyer. Of the 20 million tons of coal purchased by TVA this year under long term contracts, western Kentucky mines are furnishing 17 million.

In seeking dismissal, the UMW denied that it "financed the mechanization of West Kentucky Coal Co. with union funds" or that it placed the company in a "superior competitive position." It also sought dismissal on grounds that the court lacked jurisdiction as the suit stood, that the suit was vague and that the damages sought were founded on "speculation and unfounded on any facts . . ."

Earlier, in a brief filed in connection with the suit, the UMW had admitted that as of July 1, 1958, it had owned 135,400 shares of West Kentucky Coal Co. stock and held another 395,000 shares as collateral on loans to various firms.

OCDM Studying Need For Oil Import Control

Currently reviewing the need for the oil import control program, the Office of Civil and Defense Mobilization heard from both pro and con factions in filed statements.

In answer to East Coast utilities, importers and consumers of residual fuel oil who had filed statements calling for an end to the control program, a rebuttal statement was jointly filed by the NCA, UMW and NCPC. The coal spokesmen told the OCDM that only by maintaining effective limitations on the importation of residual fuel oil can the oil import control program prevent substantial damage to the domestic crude oil industry. "The import control programs for residual oil and crude oil are closely related and interdependent," the coal statement pointed out. "As residual oil imports increase, domestic residual oil is displaced in many domestic markets. Consequently domestic refineries are forced to reduce their production of residual oil . . . necessitating a decrease in crude oil input by U. S. refineries."

Replying to assertions that residual fuel oil imports have not injured the coal industry, the statement declared: "In the absence of residual oil imports the domestic coal industry would now be serving a predominant proportion of the 51 million tons of coal-equivalent

energy demand on the East Coast, presently being supplied by such imports."

Coal constitutes the only dependable supply of fuel capable of meeting emergency demands of the vital industrial region of the East Coast, OCDM was told, because the imported residual oil used on the East Coast (324 million barrels in 1960) would be highly vulnerable to enemy attack and the oil and gas industries could not expand sufficiently to fill this energy gap.

Meanwhile, a House Small Business subcommittee plans to hold hearings on the impact of oil imports on domestic fuels industries. As a preliminary step, the subcommittee has mailed hundreds of questionnaires to coal and oil companies throughout the Nation which ask for detailed information. (*Coal Age*, Sept., 1961, p 45)

Hanford Amendment Killed in Congress

Faced with determined House opposition to the Hanford, Wash., atomic power plant, the Senate killed the controversial project for the first session of Congress. Although the issue is likely to be raised again next year, there is no hint yet as to the form in which it will appear.

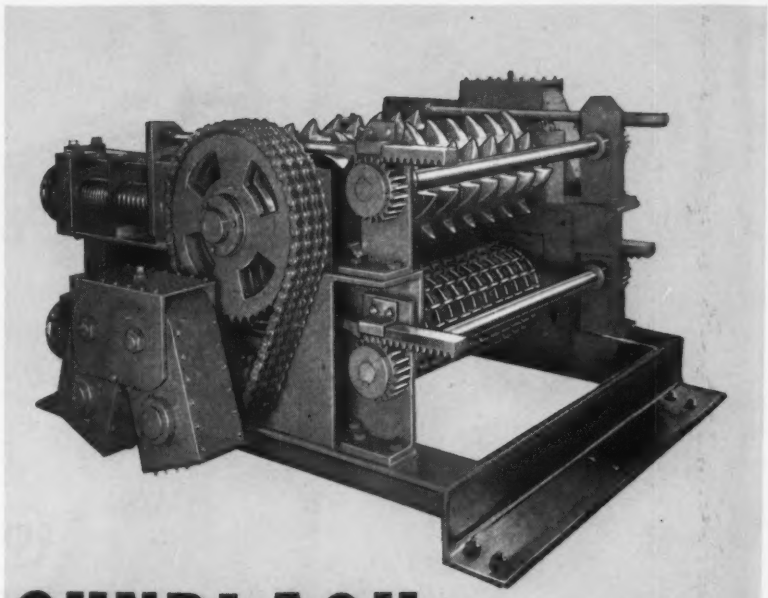
The Senate acted late Sept. 15, two days after the House had rejected a conference report containing a cut-down version of Hanford, on the basis of members' objections to even part of the public-power plan. Faced with the choice of receding or of killing the entire Atomic Energy Commission bill, the Senators reconsidered the bill and deleted the amendments they had added to the House bill—the Hanford project and the authorization for a $5 million atomic coal research project. While there had been no objection in the House to the research amendment, this restored the bill to the form in which it passed the House, and sent it direct to the White House.

Hanford officials said the AEC will spend $2,700,000 in fiscal 1962 to purchase coal for the eight steam plants at Hanford. This figure represents about 320,000 tons of coal. Six of the plants are used to provide standby electric power for the plutonium-producing reactors.

TVA Awards Seven More Coal Contracts

Representing this year's first grant of long-term coal bids not dominated by firms in western Kentucky, the Tennessee Valley Authority awarded seven contracts worth $5.6 million for 1,488,900 tons.

The tonnage is divided among four



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By Less Fines — More saleable coal in stoker sizes means more dollars per ton . . . if crushing prior to washing, fewer fines means lower washing costs.

By Flexibility . . . Can handle larger lumps and frozen coal . . . hand wheel adjustment allows you to fill any order down to ¾" top size . . . orders heretofore uneconomical to fill are now yours.

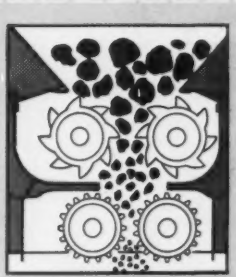
By Dependability . . . Ever-increasing list of satisfied users.

By Economical Operation . . . Less maintenance . . . Less H.P. per ton of crushed coal . . . One Crusher . . . Lower initial investment . . . No wasted labor in adjusting crusher.

YOUR CUSTOMER BENEFITS...

By Control of Top Size . . . Less unburnt coal in ashes . . . More BTU output per ton . . . Lower ash handling costs . . . Greater overall utilization.

By Less Fines . . . Simplifies unloading . . . increases boiler efficiency.



Uniformity in size consist of GUNDLACH crushed coal eliminates customer complaints, gives customer satisfaction, and increases production.

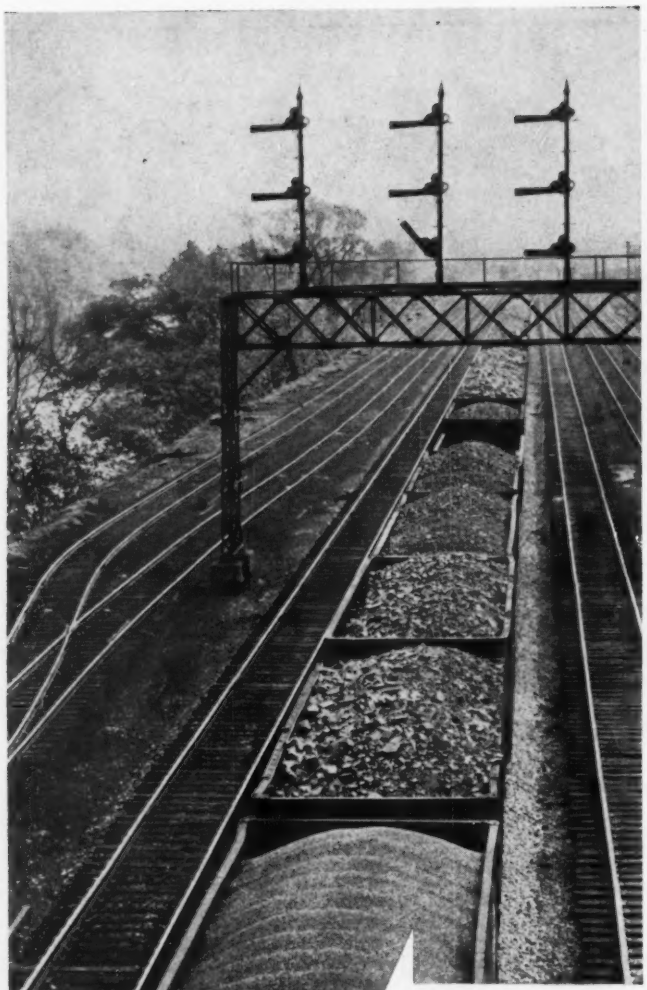
If you have a crushing problem, you'll find a GUNDLACH representative as near as your telephone.

OUR REPRESENTATIVES AT YOUR SERVICE

ANDREW M. GARDNER, 626 Park Lane, Greensburg Pa., TE 4-4346 • A. R. AMOS COMPANY, 713 Commercial Trust Bldg., Philadelphia, Pa., LO 3-8141 • J. SCHONTHAL & ASSOCIATES, Suite 309, 224 S. Michigan Ave., Chicago 4, Ill., WA 2-8350 • MARSHALL EQUIPMENT CO., P. O. Box 1367, Huntington 15, W. Va., 523-8691 • RICHARD M. WILSON, P. O. Box 1198, Wheeling, W. Va., CH 2-1052.

T. J. GUNDLACH MACHINE CO.
P. O. BOX 283 • BELLEVILLE, ILL.

Division of J. M. J. Industries



No trouble selling *this* car of coal!

In this train and in every train you see there is coal prepared by

DMS . . . the Precision Dense-Medium Coal Washer

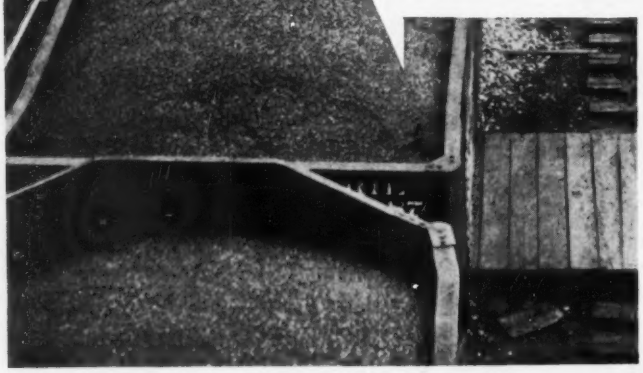
DMS is the world's leading coal washer.

DMS cleans more coal than any other dense-medium coal washer—more than 26,000,000 tons per year.

Look carefully at the DMS-prepared coal in this train.

It is the best coal in the train, for it is prepared to theoretical analysis.

No Trouble Selling This Coal!



For details on the simplicity of a DMS installation, its low cost *automatic* operation . . . and the location of the DMS plant near you, call or write The Daniels Company.

DMS — THE DANIELS COMPANY

INDIANA, PA. • BLUEFIELD, W. VA. • NEWARK, N. J.

buy BOSTON belts

The Right Belt . . . The Best Belt . . . For Every Mining Job

BOSTON ULTREX* — The new PVC belt with a tough carrying surface and superior impact and flame resistance. Smooth edges stubbornly resist edgewear. By actual test, this more compact specially-designed, single-ply carcass has best fastener-holding ability.

BOSTON FLAMEOUT 200* — Single-ply, flame resistant belt with maximum impact resistance, outstanding edge wear, and fastener holding strength. Has neoprene covers. No slipping on pulley. Improved wear-resistant cover available in any thickness. Ideal for panel and continuous miner installations.

BOSTON COLLIERY KING — Balanced Belt Construction with Dulon covers for longest service life in preparation plants and all above-ground coal handling.

BOSTON SUPER BOSTRON — Balanced Belt Construction, with Dulon or Flameout covers for severe impact and high tension belts. Ideal construction for longest service life on slope conveyors. Strong, thin carcass allows smallest diameter rolls for low coal removal. Carcass will not rot or mildew.

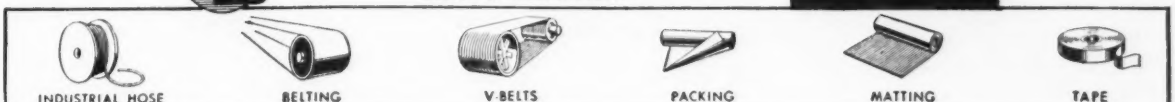
BOSTON FLAMEOUT* — Balanced Belt Construction for permanent underground installations and main entries having special tension requirements.

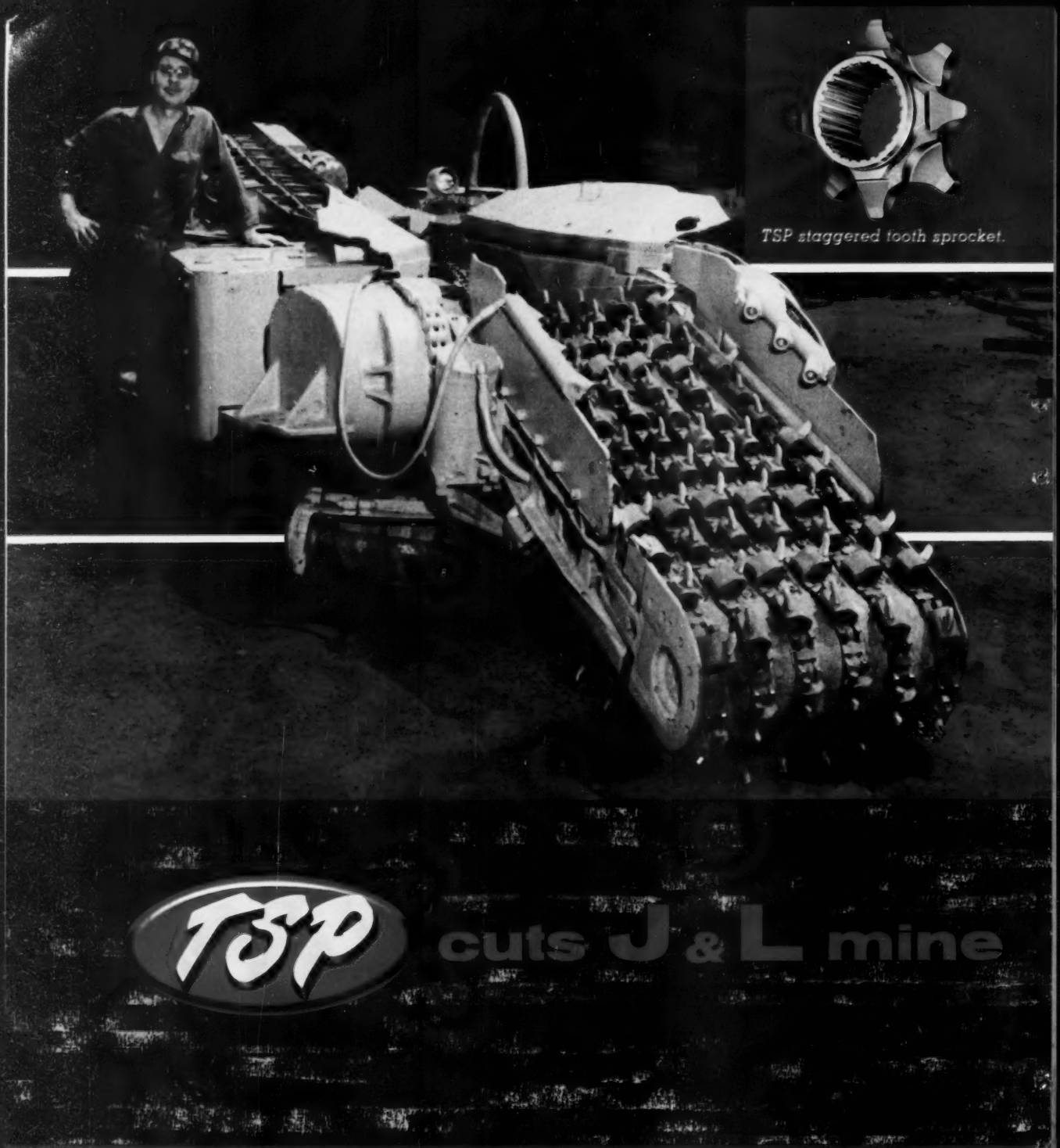
*Fire-resistant — maximum underground safety. Meets standards of U. S. Bureau of Mines Acceptance Designation No. 28-9.

Whatever your requirement, BOSTON has the right belt for the job — assuring you longer belt life . . . less trouble in service . . . greater economy!

AMERICAN BILTRITE RUBBER COMPANY
BOSTON WOVEN HOSE & RUBBER DIVISION
BOSTON 3, MASSACHUSETTS

BOSTON

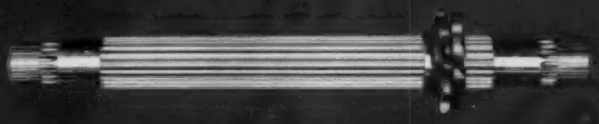




TSP staggered tooth sprocket.

TSP cuts J & L mine

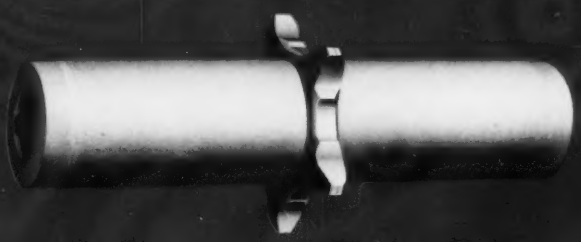
The Jones & Laughlin Steel Corporation, users of "Tool Steel Process" hardened products for over 50 years, specify many TSP products for their coal continuous miners to reduce maintenance and replacement costs. Actual performance records prove "Tool Steel Process" products last 2 to 5 times longer than competitive products formerly used in the same service. These products include gears, sprockets, rolls, shafts, drive flanges, and wheels. TSP hardened products are guaranteed in writing to out-perform, out-last any competitive product in the same service. This unusual guarantee is possible because of the unique TSP hardening process which achieves a file-hard surface to the full depth of permissible wear. The core is specially refined for toughness and ductility.



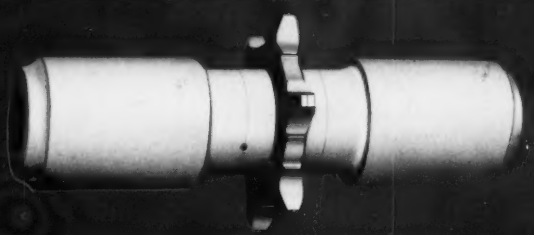
TSP splined bore drive shaft, shown with TSP staggered tooth sprocket, drives cutting chain on continuous miner.

Close-up of actual cutting chain on continuous miner.

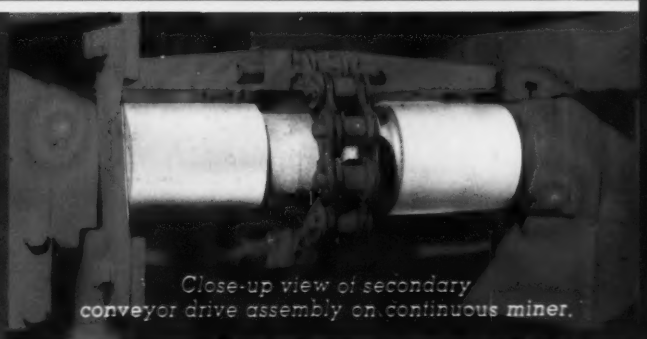
TSP sprocket tube and hub assembly for continuous miner conveyor drive.



Primary conveyor on continuous miner.



TSP sprocket tube and hub assembly on secondary conveyor drive assembly on continuous miner.



Close-up view of secondary conveyor drive assembly on continuous miner.

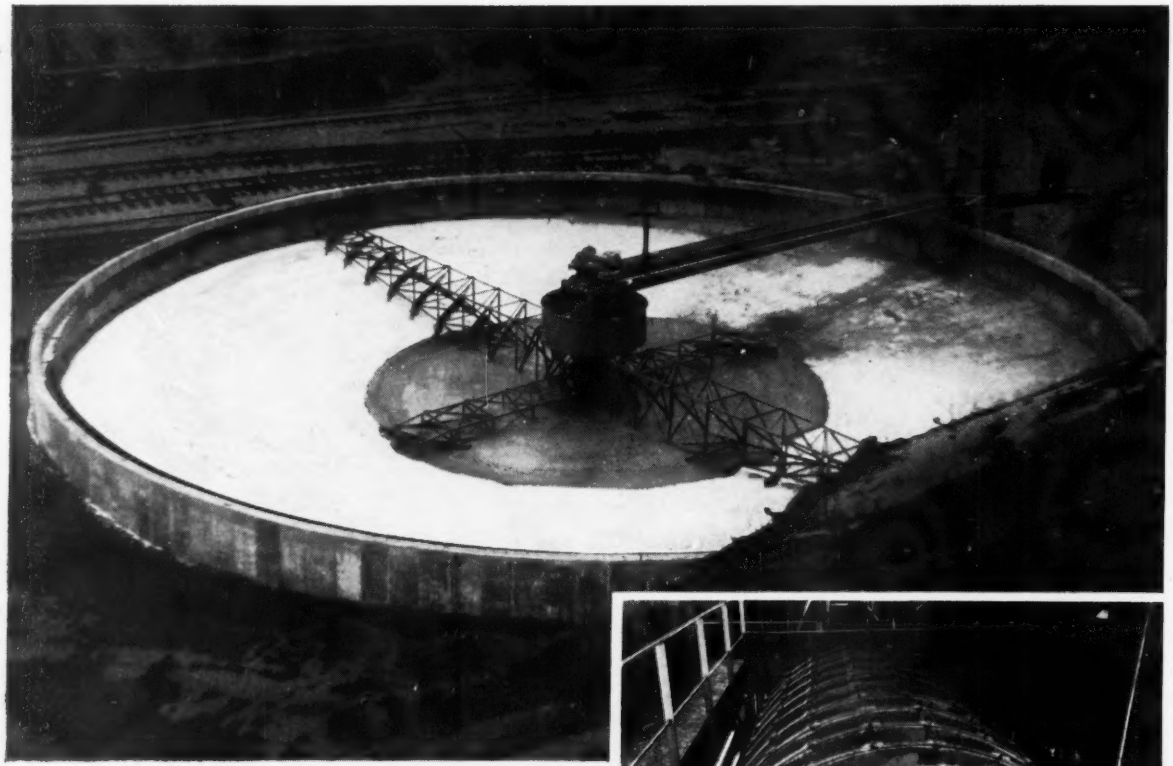
Many of the hundreds of TSP hardened products for the mining industry are carried in stock, available for immediate delivery. If you are interested in saving many dollars annually in maintenance and replacement costs, write today for Bulletin No. 857, showing TSP products for the mining industry.

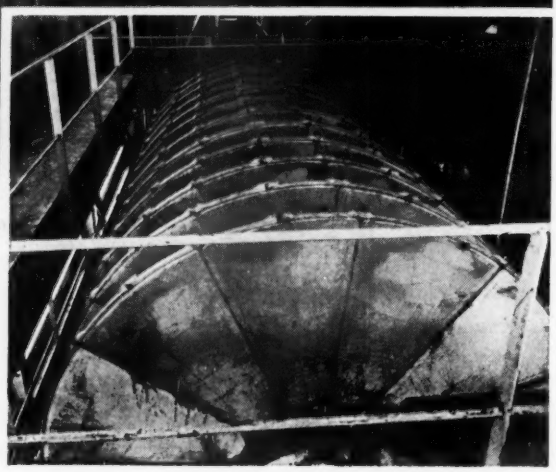
THE TOOL STEEL GEAR AND PINION CO.
CINCINNATI 16, OHIO

MEMBER OF AGMA

AD 1052
Printed in U.S.A.

The Standard of Quality since 1909 for gears, pinions, wheels, rolls and other hardened products.





EIMCO Thickener and Filter Combination for low-cost refuse handling

Added profit dollars from economical refuse handling mount up fast in coal. For example, an Eimco thickener and Agidisc filter combination can cut costs for you in all these ways — slimes removal is accomplished rapidly and economically . . . pumping and water costs are slashed . . . valuable land is no longer needed for refuse ponds . . . stream pollution worries are eliminated.

Eimco thickeners for this service are available with motorized lifting devices capable of raising the entire mechanism up out of the slurry and can be built with an underflow pumping arrangement that runs the underflow out through the center pier.

Eimco Agidisc filters for this closed-circuit operation are built with an exclusive agitation device that keeps heavy particles from settling, resulting in uniform cake formation on discs.

The Eimco representative in your area can give you valuable help in planning savings in your operations with Eimco thickeners and Agidisc filters. Call him. And write to The Eimco Corporation, Salt Lake City 10, Utah, U.S.A. for Bulletin PA-1004 (thickeners) and FA-2032 (Agidisc filters).

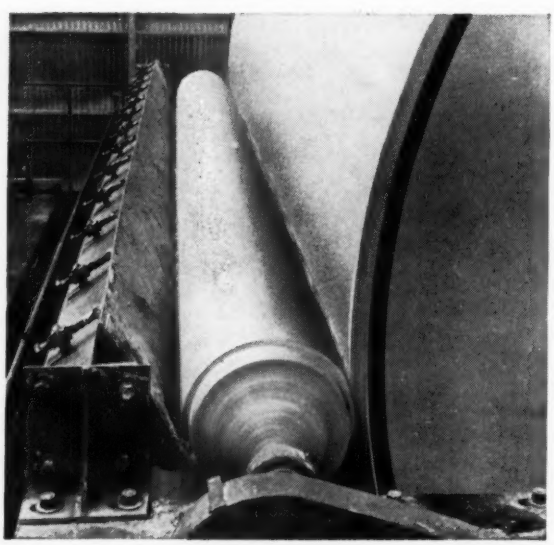
Agidisc is a trademark of The Eimco Corporation.

EIMCO

"Advanced Engineering and Quality Craftsmanship Since 1884

B-816

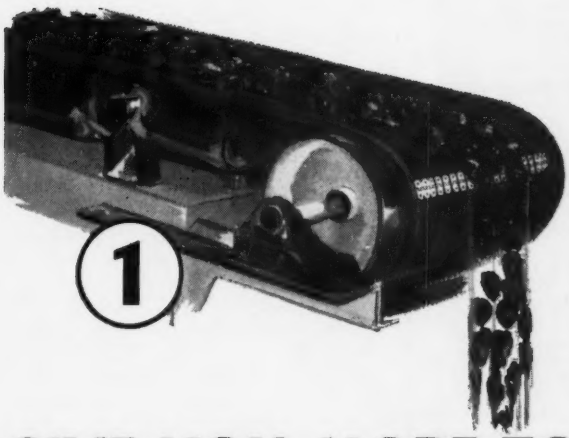
Eimco thickeners and Agidisc filters in coal plant. For high ash refuse, Eimco roll discharge drum filters (below) are often used.



FROM FACE-TO-TIPPLE

FLEXCO HINGED & FLEXCO®

BELT SPLICES



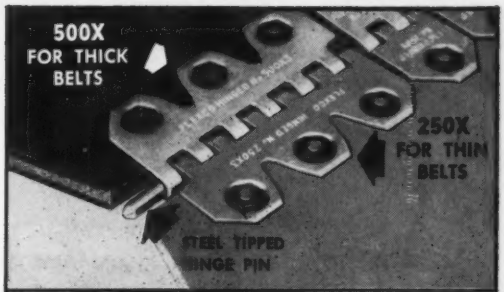
GIVE YOU MORE TONNAGE... AT LESS MAINTENANCE COSTS!

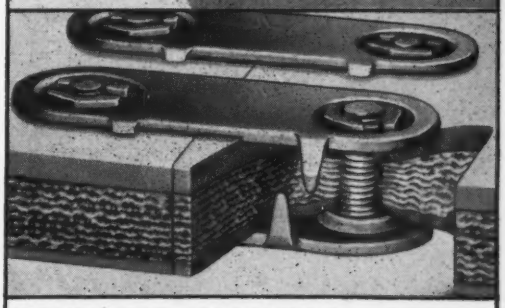
(1) FLEXCO HINGED FASTENERS (No's. 500X & 250X)
FOR GATHERING AND PANEL BELTS

- One type fastener to join belts of different thicknesses — 500X, for thick belts, will mesh with 250X, for thin belts.
- Tremendous holding power on worn or new belts. Require fewer holes (unlike perforating type fasteners which weaken belt with many damaging holes).
- Steel tipped nylon covered hinge pin, pioneered by Flexible — will not work out of splice!

(2) FLEXCO FASTENERS ***FOR MOTHER BELTS***

- Same excellent holding power as Flexco Hinged plates.
- Make a tight-butt joint . . . trough naturally.
- Teeth are spaced for best gripping action on both sides of belt.
- Easy application . . . damaged plates quickly replaced . . . ideal for new or worn belts!





SEE YOUR DISTRIBUTOR, OR WRITE FOR BULLETINS HF-502 & F-112

Flexible

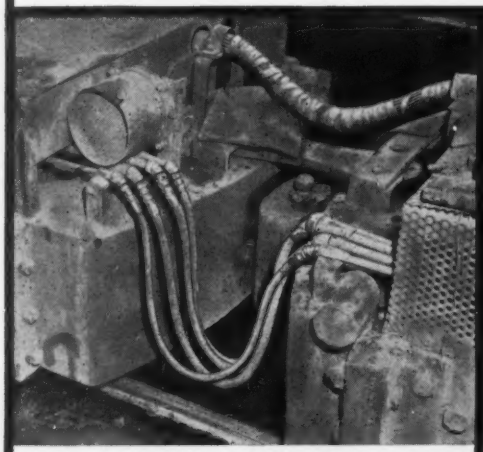
STEEL LACING COMPANY

4638 LEXINGTON STREET, CHICAGO 44, ILLINOIS

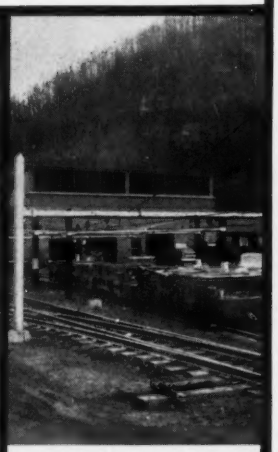
FLEXCO MIKE'S
"MAINTENANCE TIP"

"Before applying new splice, be sure to cut belts back to sound material wherever ends have deteriorated or been damaged."

Aeroquip Hose and Reusable Fittings help keep mine cars at work



Mine cars rely on hydraulic lines of Aeroquip Hose and Reusable Fittings for long on-the-job reliability.



Dependable hose line performance maintains equipment on the job.

KEY TO DETAIL INFORMATION SEE OUR CATALOG COPY IN COAL INDUSTRY PURCHASING MANUAL

A large coal mine in West Virginia reports: "An Aeroquip installation is a lasting one. It cuts downtime and helps keep our mining equipment at work. On-the-job hose line assembly cuts out a large inventory."

In this mine Aeroquip Hose and Reusable Fittings keep a wide variety of equipment such as mine cars, hydraulic pumps, valves and motors in efficient running order at operating pressures to 1500 psi. When infrequent replacement is necessary, a length of Aeroquip Hose cut from a bulk coil and quickly assembled with Reusable Fittings is all that is needed. Fittings can be used over and over again.

Similar reports from enthusiastic users show you're in good hands when you consult with Aeroquip. Full information on the superior performance of Aeroquip Hose and Reusable Fittings is contained in Industrial Catalog No. 204. Your Aeroquip Distributor will give you a copy and discuss the broad range of fluid line applications that will be of help to you. His telephone number is in the "Yellow Pages" under "Hose."

Aeroquip

AEROQUIP CORPORATION • JACKSON, MICHIGAN
Industrial Division, Van Wert, Ohio • Western Division, Burbank, Calif.
Aeroquip (Canada) Ltd., Toronto 19, Ontario
Aeroquip G. m. b. H. Baden Baden-Oos, Germany
AEROQUIP PRODUCTS ARE PROTECTED BY PATENTS IN U.S.A., CANADA AND ABROAD

producing fields: East Kentucky, 52,200 tons; east Tennessee, 392,700 tons; southern Illinois, 783,000 tons; and Virginia, 261,000 tons. The largest single contract went to Lafayette Coal Co., Chicago, for $2,951,910 for 783,000 tons of southern Illinois coal.

So far this year, TVA has awarded long-term coal contracts worth $64 million for a total of 21.4 million tons. Of this total, 17 million tons will be produced by western Kentucky mines.

Railways Ask Oil Freight Rate Cut

The federal railways, still struggling to counteract the lure exerted by river and road transportation, now want to cut heating-oil freight charges. This planned cut would give heating fuel a definite edge over coal which so far has been enjoying slightly cheaper railway freight rates than oil.

The railways application, submitted to the Federal Transport Ministry, would cut charges by an average of 10 to 30% depending on area of destination. In some instances, cuts would amount to as much as 60%.

This put the government in a tight spot. An affirmative decision would create a situation that would be in sharp contrast to the Federal energy policy since the government has been making various efforts to increase competitiveness of domestic coal against oil. On the other hand, cheaper river and road transportation presents a very real threat to railways which have managed to almost break even last year after many years of operating losses.

The railways point out that the proposed cut is not intended to make heating oil transport per se cheaper but only to counteract the competition.

Coal-Fired Gas Turbine Research Progressing

Can coal recapture the nation's railroads as a major consumer of coal?

Probably not immediately but a recent Bureau of Mines development in connection with a coal-fired gas turbine has brightened chances considerably.

The bureau has developed and opened bids on special cleaning equipment to remove fly ash from hot gas leading to the turbine. The inability to control fly ash to minimize wear on the hundreds of blades had been a major deterrent in past attempts to develop the turbine.

Providing that the new cleaning devices—known as electrostatic precipitators—satisfactorily accomplish their purpose and that the bureau can iron out any other minor difficulties that may ex-

(*Continued on p 82*)

between AMSCO and other hard rock track shoes

There's *more than just a little difference* between Amsco manganese steel hard rock track shoes and other brands. Amsco shoes are built to take the impact and abrasion of the hardest rock.

H. E. Lowdermilk Construction Company, Englewood, Colorado, and Espanola, New Mexico, specializes in rock work where the going is rough and tough. Standard track shoes for one of their HD21's *wore out completely* in as little as 270 hours. Amsco 26″ manganese steel track shoes were specified and 302 hours later wear was only 3/16″.

Mr. Howard Neff, mechanical superintendent for Lowdermilk, can actually measure the difference between the Amsco shoes and the ones they used to use. You will too. Just ask for Amsco shoes, available for all major makes of crawler tractors and in any special design you need.

Amsco makes a complete line of cast tractor parts, including end bits, replaceable sprocket rims, grouser bars and welding electrodes for buildup, repair and hardfacing.

AMSCO

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILLINOIS

AMERICAN Brake Shoe COMPANY

Other plants in:
Denver • Los Angeles • New Castle, Delaware
Oakland, California • St. Louis
IN CANADA: Joliette Steel and Manitoba Steel Foundry Divisions
IN MEXICO: Amsco Mexicana, S.A.

963

MINING REVOLUTION in the MAKING

NEW giant 3850-B is the world's largest stripping shovel with a capacity of 115 cubic yards.

NEW 480-W special walking dragline is available with bucket capacities from 12 to 18 cubic yards.

NEW 1250-W walker is available in capacities up to 40 cubic yards and boom lengths up to 285 feet.

NEW 1054-WX Bucyrus-Erie wheel excavator is one of a complete new line of wheels for large or small jobs.

Bucyrus-Erie invests in the future of coal!

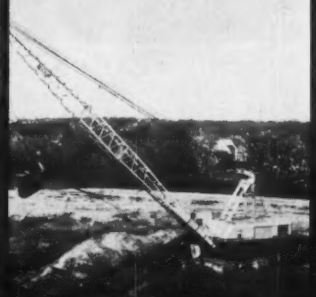
Leading the way to new production economies is a whole new lineup of Bucyrus-Erie machines . . . machines that bring you a new concept for mining efficiency. What you see here are *only a few* of many Bucyrus-Erie developments that help producers increase output and lower costs per ton more than ever before . . . new stripping shovels with capacities never before known . . . and a line of large-to-small wheel excavators.

When you look for new production economies, you are invited to consult with the only company in the world qualified to objectively recommend and sell any size, any type of shovel, dragline, wheel or drill. Bucyrus-Erie Company, South Milwaukee, Wisconsin. 4161

BUCYRUS-ERIE COMPANY

NEW 30-RP blast hole drill, like all Bucyrus-Erie drills is backed by the finest service in the industry.

NEW 210-B is available as dragline, stripping shovel or coal loader from 7 to 12 cubic yards . . . with electric or diesel-electric power.



NEW 270-B has capacities from 8 to 18 yards . . . this model has 100-ft boom, 58-ft handle, 8-yd heavy-duty dipper, with crawlers of 72-in. treads over 32 ft long.

NEW 1850-B is a new stripping shovel now being designed for a major coal producer . . . capacity: 90 cu. yd.

Safety Activities . . . Awards and Contests

Outstanding Safety Record Cited

Colorado Fuel & Iron Corp.'s Frederick coal mine, 14 mi west of Trinidad, Colo., achieved one of the best safety records in mining history.

Until it closed last March, the Frederick mine had operated 3,190,260 man-hours over a period of 5 yr without a fatality or permanent disability. Opened in 1907, the mine has since produced 20,688,794 tons of coal for use in the Pueblo steel mills. In the future, the company's Allen Mine, 30 mi west of Trinidad, will supply coking coal for the Pueblo mills.

National Safety Council Bestows Safety Awards

Five operations of Bethlehem Mines Corp., Bethlehem Steel's mining subsidiary, received National Safety Council awards Sept. 13 for 1960 achievements.

The council's highest award—the Award of Honor—was earned by Mine No. 58 at Marianna, Pa.; Mine No. 51 at Ellsworth, Pa.; and the Elkhorn Div. at Jenkins, Ky. The Award of Merit, second highest award, went to Mine No. 101 at Century, W. Va., and Mine No. 74 at Johnstown, Pa. The corporation's chemical laboratory at Johnstown received the third highest honor—the Certificate of Commendation.

The impressive record of Mine No. 58 established 1,676,703 man-hours worked from Nov., 1958 to Dec., 1960, without a disabling injury. This record is continuing and, as of Aug. 31, 1961, the accumulated man-hours totaled 2,034,663.

Mine No. 51 finished 1960 with a frequency of 5.17, showing a marked reduction in frequency and severity of disabling injuries as compared with its past record and with other coal mines of the nation.

The Elkhorn Div. concluded the year with a frequency rate of 3.88, also an outstanding performance in 1960 over past years.

In addition, the Johnstown chemical laboratory, under the continual direction of Chester Watts, chief chemist (now retired), worked 634,992 man-hours from 1919 to 1960 without a disabling injury.

First Aid and Mine Rescue Meets

• • • 17th Annual Ohio Miners' Safety and Accident Prevention Meet, St. Clairsville, Ohio, Aug. 26.

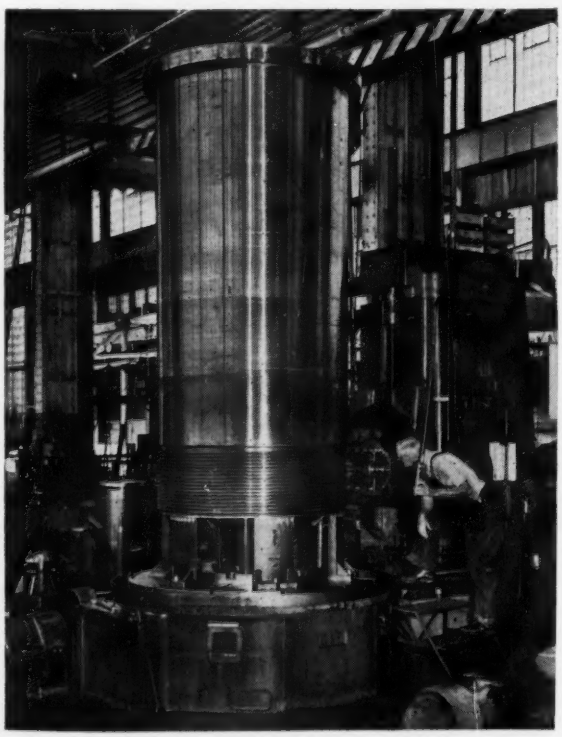
Hanna Coal Co. teams chalked up winning scores for the first four places in the first aid contest.

Piney Fork No. 15 mine came out on top with first-place honors while the Georgetown Preparation Plant placed second. Running close behind, the Gorgetown No. 12 team came in third and the Ireland No. 8 mine, fourth.

During the meet, four mines were presented with awards for safety records compiled during the past year. They were the Glencastle Mine, Hanna Coal; Powhatan No. 3 mine, North American Coal Corp.; and the Bud No. 2 and Nelms No. 2 mines of the Youghiogheny & Ohio Coal Co.

• • • 6th annual first aid contest sponsored by the Fayette Raleigh Wyoming First-Aid League, Beckley, W. Va., Aug. 19.

A joint venture between the coal com-



THIS CENTER PINTLE in a Bucyrus-Erie Co. machine shop will eventually become part of a mammoth stripping shovel, Model 3850-B, one of two ordered by Peabody Coal Co., St. Louis, Mo., for delivery early in 1962 and early 1963. These 115-cu yd, electrically-driven, revolving shovels will be the world's largest mobile land machines.

Production lost by accidents like this can cost more than the original cable. The exceptional crush-resistance of Anaconda flat shuttle-car cable repays your cable investment many times over by assuring minimum downtime.

Even if this should happen, flat Anaconda shuttle-car cable stays on the job

When a machine runs over Anaconda *flat* A-C or D-C shuttle-car cable, its weight is spread evenly over all the conductors, instead of being concentrated at a few points, as it is with round cable. The conductors won't shift under the jacket, because the insulation is shaped to fit the jacket exactly—D-shaped on the outside conductors and square on the center conductors.

The flat shape is safer for personnel, too, because it won't roll when stepped upon.

Inside, nylon breaker strips separate the insulated conductors, for extra crush resistance and less chance of conductor-to-conductor shorts. Tough Neoprene insulation, color-coded for easy identification, reduces conductor cutting action to a minimum. A specially compounded Neoprene jacket, which has proved its abrasion resistance through years of service, is reinforced by a rugged nylon web. For A-C service special grounding conductor construction lets you use ground trip relay systems.

For more information about Anaconda flat shuttle-car cable for A-C or D-C systems, contact the Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York, Department EFL-1-CA.

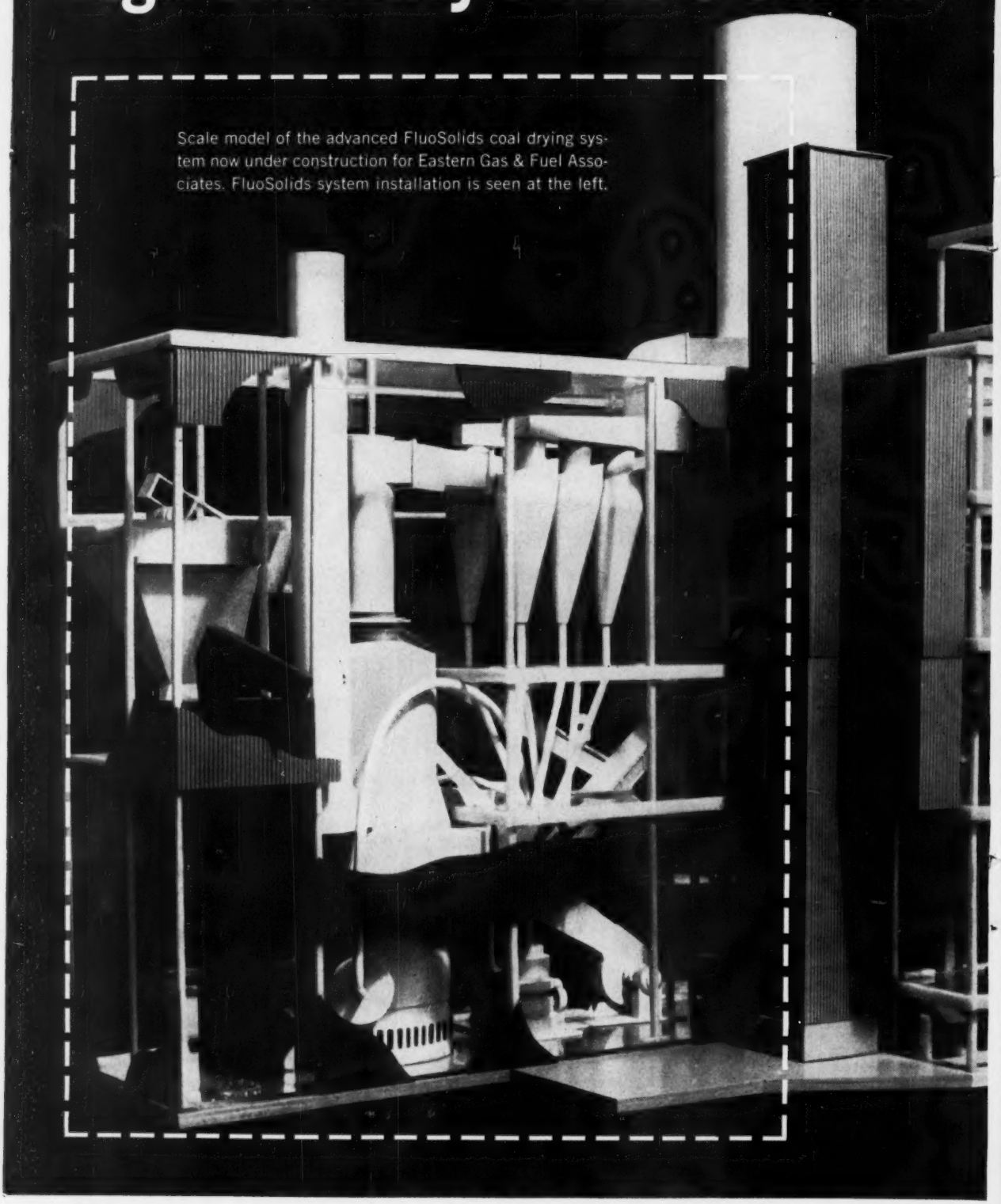
61256

ASK THE MAN FROM

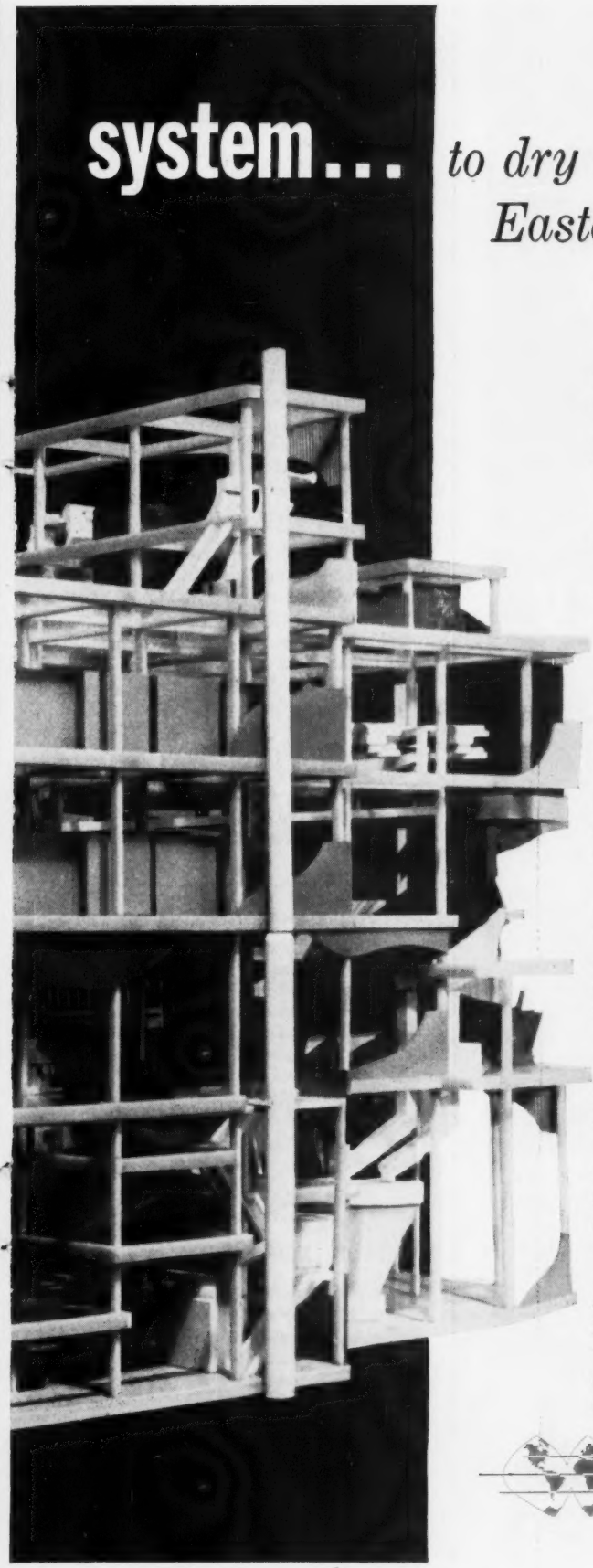
ANACONDA®

FOR FLAT SHUTTLE-CAR CABLE

High efficiency FluoSolids®



Scale model of the advanced FluoSolids coal drying system now under construction for Eastern Gas & Fuel Associates. FluoSolids system installation is seen at the left.



system... *to dry coal for Eastern Gas & Fuel Associates at Federal No. 1 mine*

Designed to remove up to 33 tph of water, a Dorrco® FluoSolids system now under construction for Eastern Gas & Fuel Associates, at Grant Town, W. Va., soon will rank as one of the most significant coal drying installations in the East.

With start-up projected for late 1961, the new unit will process 465 wet tph of ¾" x 0 coal, evaporating 33 tph of water.

Since its introduction in 1954 the Dorrco FluoSolids coal dryer has established unrivalled standards of efficiency and economy . . . wherever it has been installed. The hard-fact reasons why are these—

The FluoSolids dryer conserves space... because it is of compact, unitized design. It provides rapid start-ups and shut-downs... it burns pulverized coal, today's most accepted means for efficient fuel utilization.

The FluoSolids system saves fuel... none is consumed during shut-down. The system adjusts quickly to variations in feed conditions... because feed rate is controlled instrumentally and automatically.

Uniform fluid bed temperature, varies no more than 5 degrees F., with no localized hot spots. Because of the inherent characteristics of a *true* fluid bed obtained only in a Dorr-Oliver FluoSolids reactor, drying is uniform, resulting in a product which will meet specified requirements.

The controlled humidity exit conditions in the FluoSolids reactor promotes high cyclone collection efficiency and eliminates dusting conditions due to over-dried fines. Result—a white stack.

Power costs are lower... since the FluoSolids dryer operates with lower air volume than any other system. Feed size can range from filter cake on up to a top size of 1½" coal. And the FluoSolids dryer handles small tonnages as readily as feed rates up to 800 tph.

Your coal preparation facility will be more efficient and more economical with a Dorrco FluoSolids coal drying system... engineered for your facility.

For complete information on today's most advanced coal dryer write Dorr-Oliver Incorporated, Stamford, Connecticut.

DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

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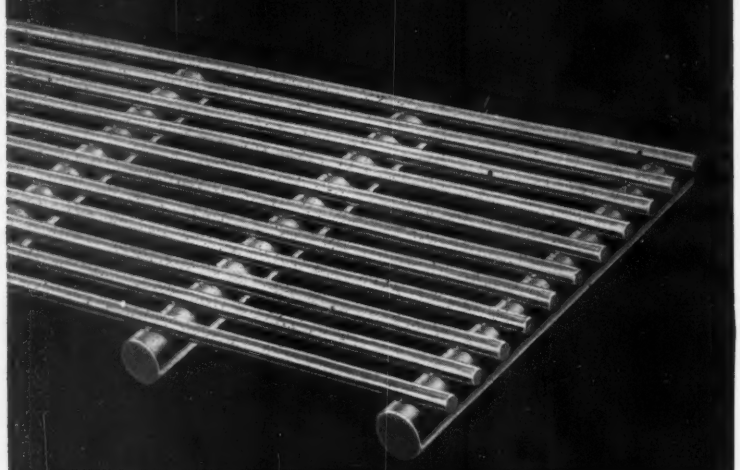
SCREENS THAT MAKE YOU MONEY



■ Your product has to be best . . . and so do your screens. Your present equipment can be equipped with Bee-Zee Screens, round-rod as shown above or in any of the special rod shapes shown below. Screens are all-stainless-steel and *all-welded*, with electronic control spacing the rods precisely. Find out how Bee-Zee Screens turn problems into profit—to make you money. Wire, write or phone Galesburg DIckens 2-5154 collect.

BIXBY-ZIMMER
ENGINEERING CO.
1100 Abingdon St., Galesburg, Ill.

Bee-Zee Screens in a wide variety of shapes and sizes meet the needs of leading firms in the coal, minerals, quarry, oil, food, chemical, plastic, brewing, distilling, pulp and paper, rubber and other industries.

panies, UMWA, State Department of Mines and the Bureau of Mines, this organization is reputed to conduct the largest annual area first-aid contest in the Nation, although this year, with 21 teams, constitutes the smallest field since the league's formation.

Island Creek Coal Co.'s Wyoming team copped top prize in the first aid activities with a long record of past victories to their credit. Second place went to Gary No. 2 team, U. S. Steel; third place, Tralee team, Allied Chemical Corp.; and fourth place, Montcoal No. 1 team, Armco Steel Corp.

First mine rescue honors were claimed by U. S. Steel Corp.'s Gary District team. These included individual awards and a trophy presented by Vascoloy-Ramet Corp. The Holden Div. team of Island Creek Coal Co. placed second. The two other competing teams were Montcoal of Armco Steel Corp. and Bartley Div., Island Creek.

• • • The Northern West Virginia Coal Mining Institute Safety Day, Hough Park, Mannington, W. Va., Aug. 12.

Individual cups and $25 cash awards were presented to the top first-aid winners, a team representing Bethlehem Mines Corp.'s Idamay Mine No. 44. Placing second was another Bethlehem team—No. 1 of Barrackville Mine No. 41—who won cups and $20 awards. Third place winners, a team representing Mountaineer Coal Co.'s Owings Mine No. 32, who received cups and $15 awards.

News (*Continued from p 74*)

ist, a fairly rockfree path will have been cleared toward the railroad market. Coal has the price advantage here, too, at least for the present, and an attractive added inducement is the fact that present railroad equipment could be used in the conversion.

The experimental turbine, loaned to the bureau by Bituminous Coal Research, Inc., is being rebladed in preparation for operation.

Kentucky Committee to Promote Mineral Resources

A special committee has been appointed by Kentucky's Governor Bert T. Combs to promote the state's natural resources and particularly its minerals. Called the Resources Research & Development Advisory Committee, it will advise the Department of Economic Development.

Fred B. Bullard, president, Kentucky Coal Association, is chairman of the committee. Other coal members include Harry LaViers, president, South-East Coal Co.; B. F. Reed, secretary-treas-

Dollar for dollar
in cost of cutting,
Bowdil Bits
OUTPERFORM
all others.

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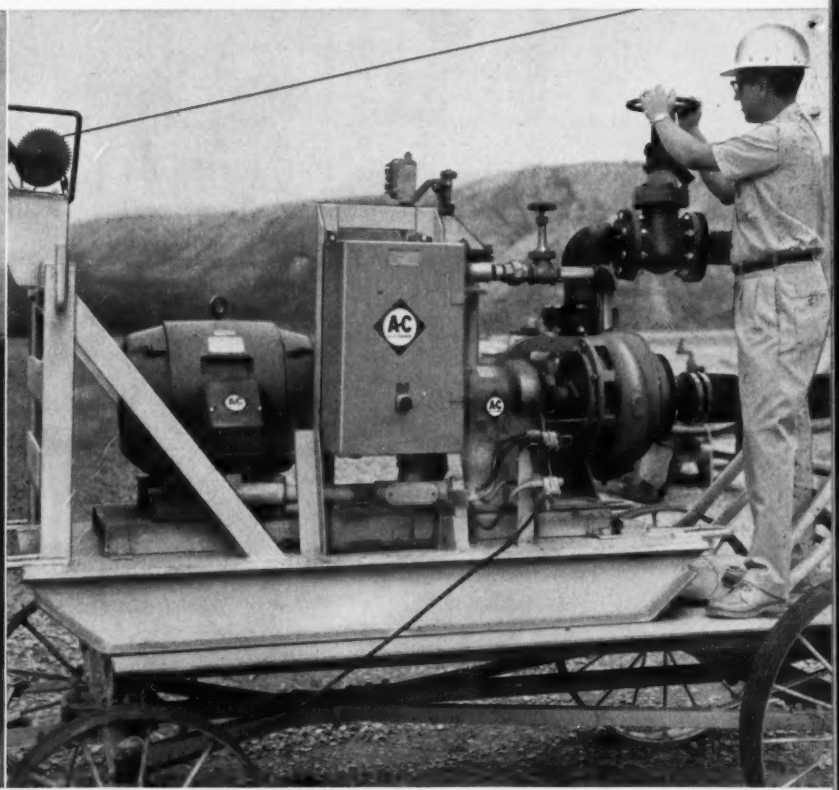
CANTON, OHIO

ideas and news:



Low-cost system will automatically correlate coal-loading data: This data-handling system will automatically weigh bulk coal shipments and transmit invoicing data to a central billing office for a midwestern coal producer. The system will effect substantial savings in manpower. It was developed by Allis-Chalmers through its exclusive SYSTEMATION service.

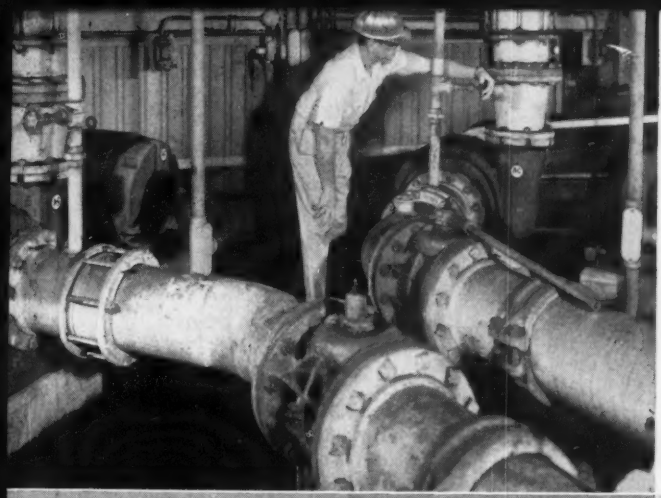
Allis-Chalmers portable pump gobbles up water, stacks up savings: This portable pump is used in a strip-mining operation to clear flooded pits. It is equipped with a 40-hp SUPER-SEAL motor, a 6 x 5 frame-mounted Allis-Chalmers pump, and a Size 3 weather-protected Allis-Chalmers motor control. Recommended by Allis-Chalmers to empty flooded pit area faster, this larger pumping unit requires no more total power than the smaller unit it replaced. And the SUPER-SEAL motor withstands weather, moisture and abrasives.

Which of these productive ideas could be working for you?

A low-cost data-logging system. Open motors that shrug off moisture and abrasives. Power equipment designed for you. These examples demonstrate the extra value that is standard with A-C...the greater efficiency and added productivity which are yours when you buy A-C products, systems and services. Call your Allis-Chalmers representative for details on A-C "worth-more" features. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

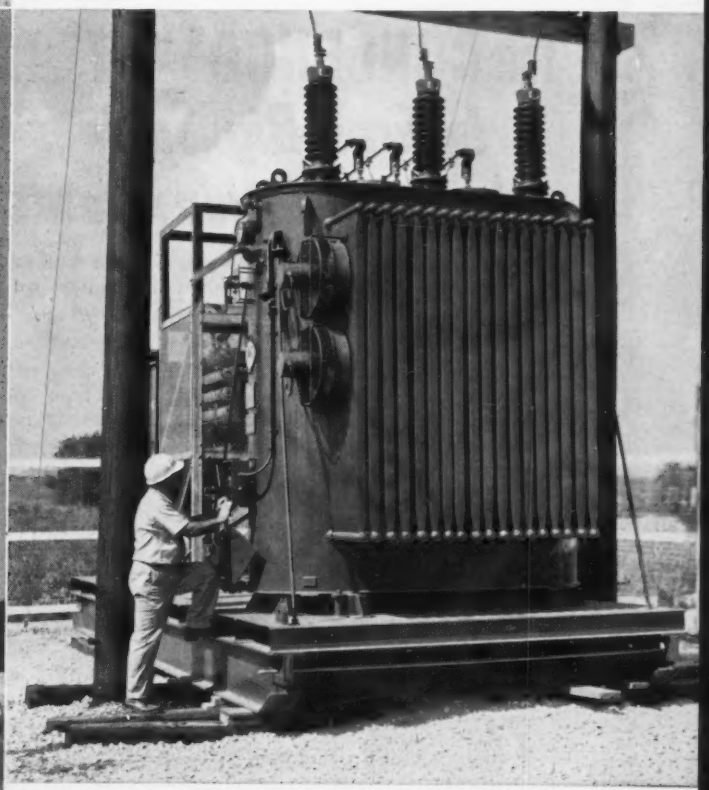
Super-Seal and *Poxeal* are Allis-Chalmers trademarks.

A-1555



Open motors like it damp and dirty: In an Illinois coal-preparation plant, these 100-hp SUPER-SEAL motors are driving Allis-Chalmers 10x8CW pumps that handle fine coal in suspension. Remarkable POXEAL insulation in these motors is impervious to moisture, dust and most contaminants. And because SUPER-SEAL motors are **open** motors, they offer a 15% greater service factor than totally enclosed units.

Skid-mounted semi-permanent substation: Built to move when operations shift is this transformer/circuit breaker unit. Skid mounted at the factory, this substation furnishes power for the shovel on the left. Transformer is dual rated 3750/4687 at 55°C rise. 4200/5250 kva at 65°C rise. The type OZ oil circuit breaker has 3-tank design to give absolute phase isolation — one faulted phase cannot affect other phases.

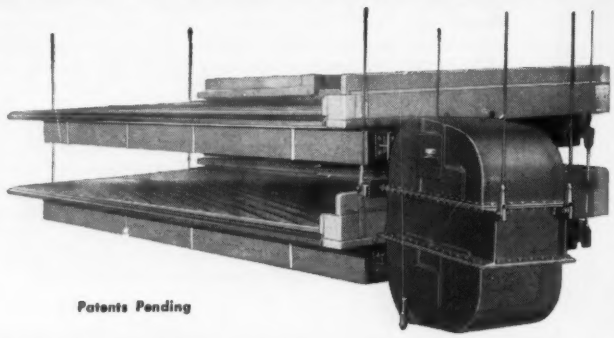


Circuit breaker gets dragged around all day: This A-C skid-mounted "breaker house" serves a 65-yd shovel . . . moves right along with it. Good example of Allis-Chalmers ability to meet customers' specialized needs. The oil-type breaker is combined with a current transformer and potential transformer on the specially designed skids.

ALLIS-CHALMERS PRODUCTS: Look to Allis-Chalmers for compressors; controls; crushers; earth-moving equipment; engines; generators; industrial systems; lift trucks; motors; pumps; rectifiers; **vibrating screens;** electrical generation and distribution equipment; tractors; transformers; unit substations; valves.

Systemation is an Allis-Chalmers servicemark.

ALLIS-CHALMERS



Patents Pending

The CONCENCO® "77" Table *Insures Big Savings in Preparation Plants*

Whether you are preparing metallurgical coal or washing fines for the commercial market it will pay you to investigate the huge savings made possible by the CONCENCO "77" twin deck table.

Each deck performs with the same high efficiency as the famous SuperDuty® single deck table, yet no more floor space is required. The result is twice as much cleaned coal in a given unit of floor area, long deferring new plant construction cost.

When new building *is* required, the construction may be lighter because floating suspension of the tables reduces impact. Also, piping, laundering and service connections are halved.

There are other savings, too. Send for Bulletin 77.

CONCENCO

Feed Distributor

While unexcelled for feeding coal washing tables, the CONCENCO Feed Distributor effectively provides an accurate splitting of feed into any desired number and proportion of parts to feed circuits or machines in battery for their greater overall efficiency. It is a heavily fabricated all steel machine with motor drive requiring 1 h.p. or less in operation.

THE DEISTER★ CONCENTRATOR COMPANY

CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*

909 Glasgow Ave. • Fort Wayne, Ind., U.S.A.

urer, Turner Elkhorn Mining Co.; John H. Gray, assistant to the president, West Kentucky Coal Co.; George E. Evans Jr., president, Evans Elkhorn Coal Co.; John M. Crowl, executive director, Kentucky Reclamation Association; and C. E. Beane, president of Dist. 30, UMWA.

Military Advisory Board For All Fuels Asked

In an attempt to head off reported Defense Dept. plans to reactivate the Military Petroleum Advisory Board, a bipartisan Congressional group requested the department to substitute a Military Fuels Advisory Board on which all domestic fuels industries would be represented. The group consisted of 62 House members and two Senators.

The House group, for which Rep. W. Pat Jennings (D-W. Va.) acted as spokesman, said in a letter to Defense Secretary McNamara: "The worsening international situation makes it imperative that this board have at its disposal the most comprehensive answers that are available concerning the production, distribution and consumption not only of petroleum but coal and natural gas as well."

Joseph E. Moody, president, National Coal Policy Conference, related the nation's experience during World War II when coal had to expand production significantly to meet oil shortages caused by an interruption of overseas supplies.

In a separate letter to McNamara, Senators Jennings Randolph (D-W. Va.) and Robert C. Byrd (D.-W. Va.), suggested formation of a Military Advisory Board on Coal and Coke which might appropriately be combined with the Military Petroleum Board to form a top-level Military Fuels Advisory Board. As an alternative they urged creation of a single fuels advisory board "to include experts representative of the oil, natural gas, coal and coke industries."

Preparation Facilities

Maiden Mining Co., Poland, Pa.—Contract closed with Jeffrey Mfg. Co. for 7-ft, two-compartment, 5-cell Baum jig to handle 5x¼ coal at 250 tph.

Virginia Iron, Coal & Coke Co., Virginia City, Va.— Contract closed with Mecco Mechanical Equipment & Construction Corp. for a complete 300-tph full-size washing, sizing and storage plant. Completion Sept. 1, 1961.

Pocahontas Quality Coals, Inc., Bluefield, Va.—Purchase Authority issued to The Daniels Co. for a complete DMS dense-media precision coal washer. Completion in Sept., 1961.

10 (USS) Cor-Ten Steel trailers haul 2,478,000 cubic yards of coal 11,550,000 miles in seven years

Seven years ago, the Coal Transportation Company, Atlanta, Georgia, bought 10 bottom-dump, 30-cubic-yard trailer units built of USS COR-TEN High-Strength Low-Alloy Steel. Since then, each unit has averaged some 35,400 cubic yards of coal annually. The trailers are currently on their third set of tractors —having outlasted two previous sets.

Mr. Hubert Chatham, manager of the company, says, "If anyone had told me seven years ago that these COR-TEN trailers would deliver such terrific service, I wouldn't have believed it. Only two or three have required a few repairs on the sides and hoppers. This has been done easily by welding."

The trailers were built by the Marion Metal Products Company, Marion, Ohio. USS COR-TEN Steel's 50% greater strength and higher resistance to atmospheric corrosion and abrasion permitted light sections to be used. The trailer units weigh only 10,300 pounds empty. More payload can be hauled, and operating and maintenance costs are very low.

Reasonable first cost. 16-gage USS COR-TEN Steel was used in the sides, 12-gage in the ends and floors, 10-gage in the hopper doors, and cold-formed 10-gage in the trailer's frame members. If carbon steel had been used, these sections would have been heavier. Thus, COR-TEN gave reasonable first cost, and quickly paid for itself in lower maintenance and longer service. You can't beat USS COR-TEN Steel for handling corrosive and abrasive loads and absorbing the pounding of rough roads!

For more information about USS COR-TEN or other brands of USS High Strength Steel, write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania. USS and COR-TEN are registered trademarks

United States Steel Corporation • Columbia-Geneva Steel Division • Tennessee Coal and Iron Division • United States Steel Supply Division • United States Steel Export Company

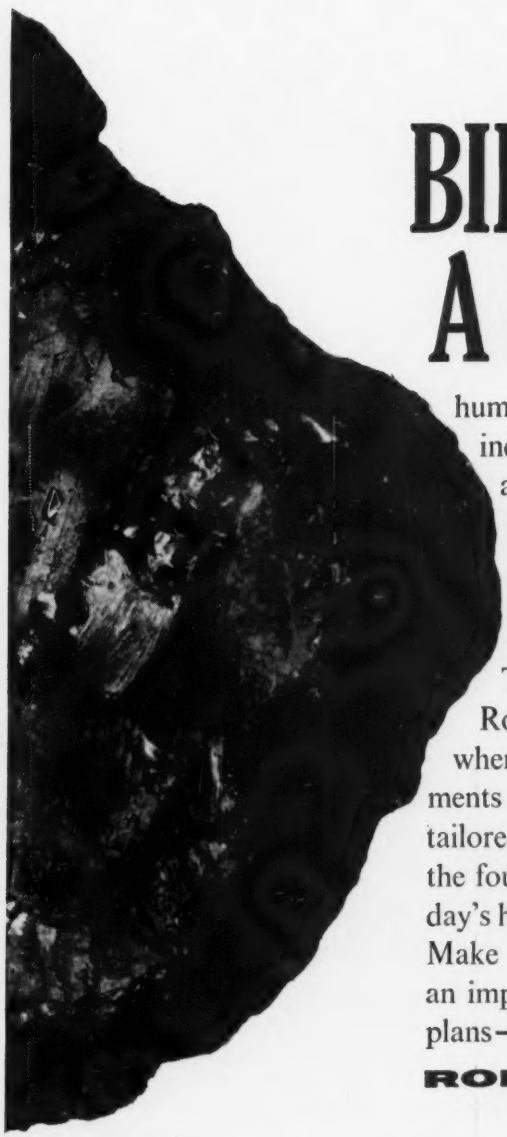
(USS)

United States Steel

This mark tells you a product is made of modern, dependable Steel.

Shown is one of the units in this 10-truck fleet that makes four, 144-mile round trips per day, 6 days a week, hauling 2" and under coal.

COAL AGE



BIRTH OF A GIANT

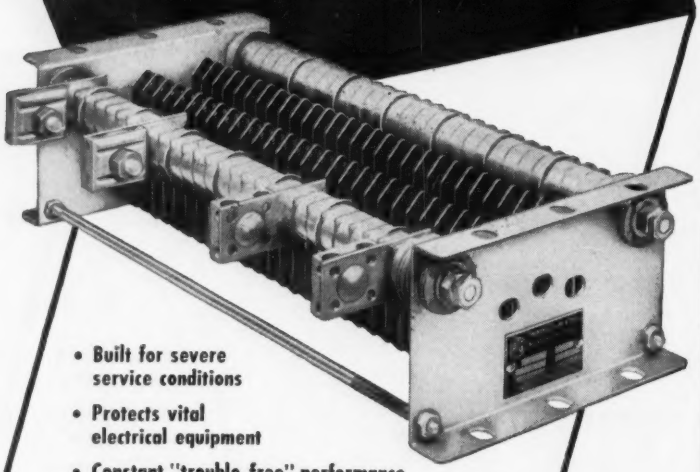
Since COAL AGE first saw the light of day fifty years ago, the industry has seen many sweeping changes. None, however, holds more significance for the future than its new reliance on machinery where for centuries the mainstay had been the human muscle. Other muscles are presently helping to lift the industry to heights of efficiency undreamed of even a decade ago. They are made of steel. They make feasible the use of heavier machinery and the handling of heavier loads with existing equipment. They make possible more continuous operation at higher capacity—efforts that are paying off to give coal a new brightness in the industrial firmament.

The new muscles are Roebling Royal Blue® Wire Rope. Roebling wire rope provided the ultimate in performance when COAL AGE was born. Now, through unceasing refinements in both the composition of its steel and in its industry-tailored designs, Royal Blue is as modern as the four-minute mile—a pace-setter for today's hard-driving machines and methods. Make Roebling Royal Blue Wire Rope an important element in your production plans—it's built for the long haul.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

P-G Steel Grid Resistor
plays an *essential part*
in the production of COAL . . .

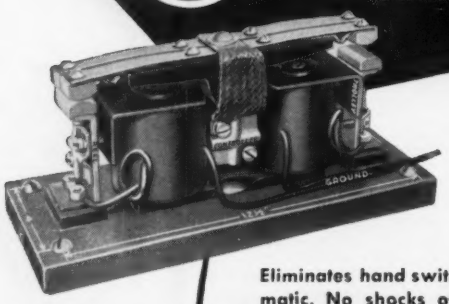


- Built for severe service conditions
- Protects vital electrical equipment
- Constant "trouble free" performance

These rugged nonbreakable units have proved their merit in all kinds of service for many years. Made of steel and mica, plus P-G unique and exclusive grid design, P-G Resistors are capable of protecting your most vital electrical equipment, even where service requirements are severe.

Designed to fit your present resistor space

P-G AUTOMATIC Transfer Switch



Single or double trolley and reel

Eliminates hand switches—entirely automatic. No shocks or burns to operator while changing from trolley to reel. Simple, safe, efficient, easy to install, can be mounted anywhere. For 250 to 600-volt service. Complete with cover.

P-G

THE POST-GLOVER ELECTRIC COMPANY
OFFICE and FACTORY—Kenton Lands Road, Erlanger, Kentucky
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Mines, Companies

After almost a year of inactivity, mining operations at Lone Star Steel Co.'s Carbon No. 5 mine, east of McAlester, Okla., resumed June 27. Three crews working around the clock are turning out between 350 to 450 tons of coal daily. This coal is used in coking ovens turning out steel at Lone Star's Daingerfield, Tex., plant.

In a recent transaction, Eastern Gas & Fuel Associates acquired a major barge line on the inland waterway system which will aid EG&FA in getting its coal to markets. The barge line is the Ohio River Co., a wholly-owned subsidiary of Midland Enterprises Inc., Cincinnati, which Eastern purchased Aug. 22.

Beatrice Pocahontas Co. has begun development of a new mine in Buchanan County, Va., to tap Pocahontas No. 3 seam coal at the rate of 1,200,000 tons annually. The company made an award to Dravo Corp., Pittsburgh, for the sinking of three shafts to a depth of about 1,400 ft. It is expected that the completion of this work will take 15 mo. Beatrice Pocahontas Co. is a newly-formed company jointly owned by Republic Steel Corp. and Island Creek Coal Co.

Ever expanding, Consolidation Coal Co. has purchased the physical assets and leased coal at four mines of the New River & Pocahontas Consolidated Coal Co., at Berwind, McDowell County, W. Va. These mines, adjoining property already owned by Consol at Amonate, Va., have an annual production totaling about 200,000 tons.

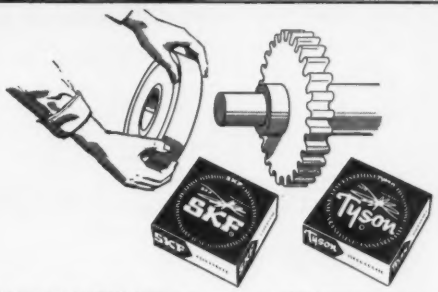
Consol has also acquired the Lilybrook and Killarney mines in Beckley, W. Va., with the purchase of the Lilybrook Coal Co., Grundy, Va., and in addition, has purchased physical assets and leased coal at Arista mine, formerly a Walter Bledsoe & Co. property.

Cannelton Coal Co. has authorized an expenditure in excess of $1.2 million for expansion of their coal mining operations at Cannelton, W. Va. Included in the appropriation is the development of a new mine, to be known as No. 8 Mine, in the Eagle seam. Shaft work has already begun and production is scheduled for Oct., 1962. In addition, the facilities of the Lady Dunn Coal Preparation Plant will be expanded. Cannelton, a subsidiary of the Algoma Steel Corp., Ltd., of Sault Ste. Marie, Ontario, Canada, furnishes the parent company with its metallurgical and by-product coal needs.

Bell & Zoller Coal Co. closed its Moss Hill Mine at Muhlenberg, Ky., Sept. 1, explaining that the mine's small size

DISTRIBUTOR DAN, the SKF bearing man, says

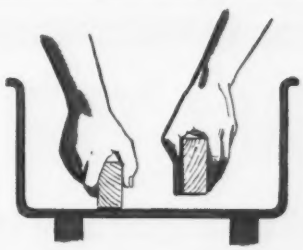
"TO SHRINK A BEARING ONTO A SHAFT GIVE IT A BATH IN HOT OIL"



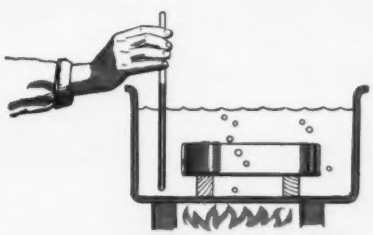
WHY HEAT IT, ANYWAY? If you need an interference fit, it's often convenient to shrink the inner race onto the shaft. To do this, you need to establish a difference in temperature. And it's usually easier to heat and expand the bearing than to cool the shaft.

SOME DO'S AND DON'TS. To heat the bearing, immerse it in hot oil. **Don't** heat the bearing over a flame. And **don't** heat it above 225°F. Plan to use enough oil—either quenching oil that has a minimum flash point of 300°F. or transformer oil.

CLEAN THE CONTAINER FIRST. If you reuse oil, make sure it's absolutely clean by filtering it carefully. Again, use plenty of oil—because too little may heat and cool too rapidly, causing the bearing to heat unevenly.

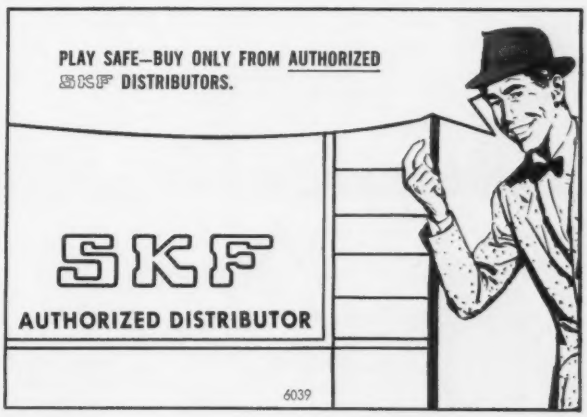


ANOTHER "HOT" TIP. Place a rack at the bottom of the container and set the bearing on it. This will prevent the bearing from touching the hot bottom. It will also separate the bearing from any contamination that may have settled on the bottom.



TO HEAT BEARING UNIFORMLY, place it in the bath as soon as heating starts. Or else allow sufficient time for entire bearing to reach temperature. Stir oil and heat at 200°F. for 15 minutes. Check temperature by immersing a thermometer near bearing.

PLAY SAFE—BUY ONLY FROM AUTHORIZED SKF DISTRIBUTORS.



SKF MOTION ENGINEERING

Advanced ball and roller bearing technology

100,000-MILE WARRANTY FOR SUPER DUTY V-8's

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NEW '62 FORD TRUCKS

Get full-time economy that only starts with Ford's low price!

Meet the trucks that make saving money a full-time business—new Ford Trucks for '62!

In a selection of over 600 models there's a truck that's right for your job, whatever your job . . . trucks that you can buy and operate at lower cost . . . trucks that can save you money mile after mile, load after load, year after year!

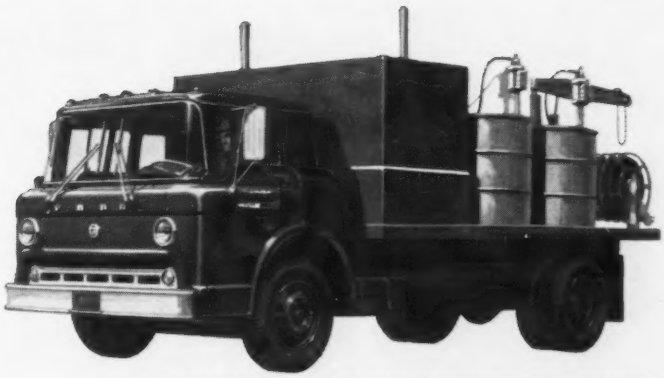
They save on price. They save on gas and oil. They save on tires and on maintenance—wherever there's a way to save! The full record of Ford economy, covering three years of independent tests, is detailed in Ford's Certified Economy Reports. See your Ford Dealer now. Check out the facts, work out a deal, and drive out a truck that saves money . . . full time!

FORD TRUCKS COST LESS

SAVE NOW...SAVE FROM NOW ON!

ECONOMICAL HEAVY DUTY V-8's with 292-, 302- and 332-cu. in. displacement give you tailored-to-the-job economy at much lower prices than you would expect in trucks with engines of this size. Stress-relieved cylinder heads, aluminum alloy pistons and sodium-cooled exhaust valves are but a few of the heavy-duty features you get with these engines.

EXCLUSIVE 100,000-MILE WARRANTY on 401-, 477- and 534-cu. in. Super Duty V-8's is the most liberal in the industry. Each major engine part (including block, heads, crankshaft, valves, pistons, rings), when engine is used in normal service, is warranted by your dealer against defects in material or workmanship. The warranty covers full cost of replacement parts for 100,000 miles or 24 months (or 3,000 hours if used as a power source for other than propelling the vehicle), whichever comes first . . . full labor costs for 50,000 miles, 12 months or 1,500 hours, sliding percentage scale thereafter.



PROVEN 262-CU. IN. BIG SIX FOR FORD MEDIUMS includes more heavy-duty engine features than any other Six of its size. Never before such long-term durability, reliability, and economy at so low a price.

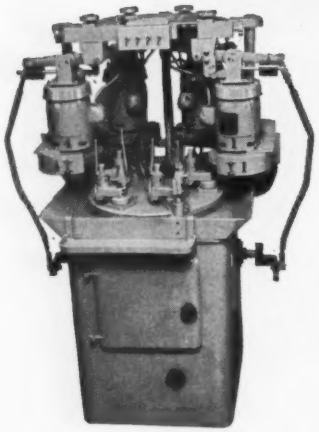
NEW STYLESIDE BODY FOR 4 X 4 PICKUPS—Ford's rugged 4-wheel drive models are now available with a cab-wide Styleside box that provides over 70 cubic feet of loadspace. Flareside body with running boards is also available.

HEAVY-DUTY CAB, RADIATOR AND SHEET METAL—All Ford Tandems utilize heavy gauge steel, sturdy reinforcements and independent mounting systems to separate radiator, fenders and cab. This stronger construction, with each component individually frame-supported, gives long life, reduces maintenance expense and cuts downtime.

PRODUCTS OF Ford MOTOR COMPANY

Cut Bit Grinding Costs!

. . . and get these extra benefits



FREE

- ★ **Better Performance**
- ★ **Uniform Results**
- ★ **Maximum Bit Life**
- ★ **Fast Production**

All of these advantages boil down to savings of both labor and wheels, productivity of 250 to 350 per hour, correct angles—smooth finish, more regrinds, more grinds per bit, more tons per grind and elimination of hazardous operation. It's to your advantage to use the FAIRVIEW BIT GRINDER both in the satisfactory grinding results obtained and in the protection of your investment in expensive equipment.

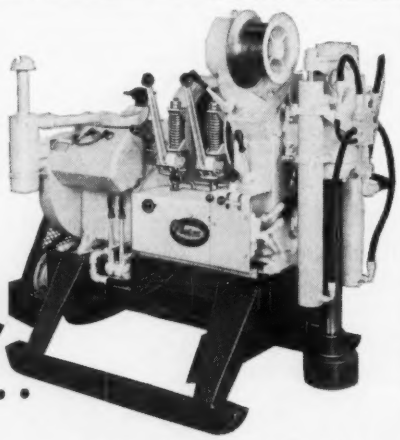
A List Of Satisfied Customers Furnished On Request WRITE TODAY for fully descriptive bulletin!

FAIRVIEW BIT COMPANY

FAIRVIEW, WEST VIRGINIA

IT'S A FACT

NEW Longyear "38" Drill works anywhere, goes anywhere...



ALL THE FEATURES drillers have asked for are combined in the new Longyear "38" Diamond Drill. Finger-tip controls and a wide range of optional equipment put the operator in complete command. Ideal for all kinds of mineral exploration jobs, blast hole drilling and site development work. The versatile "38" has new low-range speeds, optional built-in Wire Line Hoist and hydraulic retraction. Features compact design with lightweight chassis breakdown for easier transporting. Capacity, 2800 ft. with AW rods. For information, contact our nearest office.

Longyear

E. J. LONGYEAR COMPANY
MINNEAPOLIS, MINNESOTA, U.S.A.

LONGYEAR N. V.
The Hague, Holland

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San Bartolo, Mexico

CANADIAN LONGYEAR LTD.
North Bay, Ontario, Canada

CHRISTENSEN LONGYEAR (INDIA) LTD.
Bombay, India

LONGYEAR ET CIE
Paris, France

NIPPON LONGYEAR COMPANY LTD.
Tokyo, Japan

made it uneconomical to operate. Company officials said that this mine accounted for less than 5% of the company's annual production. The remaining coal reserves have been sold to another strip mine operator.

Competition

The results of a 3-yr study by the Massachusetts Institute of Technology indicates that total solar home heating, while possible, is—at least for the present—not only very expensive but impractical as well. MIT engineers have concluded that the sun can furnish two-thirds of the energy needed to supply heat and hot water for a three-bedroom suburban house in New England but the price would be high. The conclusions were based on a 3-yr study of a solar-heated house in Lexington, Mass. During solar-deficiency periods, a conventional oil burner was used.

The engineers said that it would be possible to obtain total solar heating but that in the random weather of New England, more storage space would be required than would be convenient in a small house. Moreover, at present prices, the cost of mechanical equipment required remained higher than could be justified by fuel savings.

Natural gas for consumer use has made its entry into Alaska through a natural gas pipeline completed in August. The 85-mi line, costing an estimated $20 million, runs from Kenai on Cook Inlet to Anchorage, the state's largest city.

The Alaska Pipeline Co. and its distributing subsidiary, the Anchorage Natural Gas Co., undertook the project. Wells of the Union Oil Co. of Calif. and Ohio Oil Co. will supply the gas for 20 yr to an estimated 100,000 persons. A total of 3,000 customers is expected to be connected to the line this year.

Unlike pipelines in the northeastern section of the country, no compressor stations were needed because of the natural pressure available from the gas source.

New Books

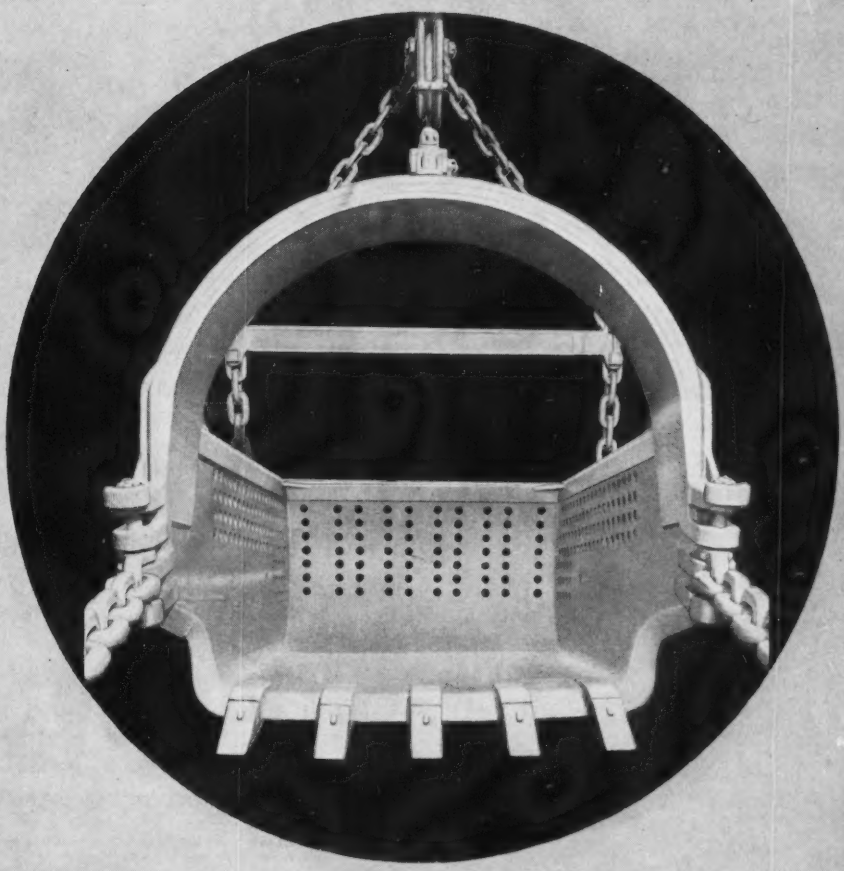
Safety

Use of High-Expansion Foam on a Pennsylvania Coal-Mine Fire describes the first use of a high-expansion plug to control an underground fire in a western Pennsylvania mine. The Bureau concludes that although foam is not a cure-all or substitute for standard equipment, it can be an invaluable supplement. *I. C. 8019. Publications-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Ave., Pittsburgh 13, Pa.* More detailed information on types of high-pressure

HENDRIX

"MH"

Heavy Duty **Mining Buckets**



MORE CAPACITY AT LOWER COST-PER-TON

3 to 40. Cubic Yards With or Without Perforations

HENDRIX MANUFACTURING CO., INC. MANSFIELD, LOUISIANA

HIGHER ARCH · WIDER FRONT · TRI-TAPERED BASKET · GREATER STRENGTH

An important

THE SPIRIT OF SAFETY ~ ~ ~ RESPECTED AND IGNORED ACCORDING TO FANCIES OF MEN

Where danger lurks you will find this spirit —never commanding, but always cautioning, and pleading for preservation of life and property. The true Spirit of Safety teaches that where dangers lurk, facts must be determined, analyzed and weighed—one against the other—before honest judgment can be passed. It has developed through countless years dating back to the beginning of mankind. To its fullest further development we are irrevocably committed.

Our closest interest in Safety lies in the promotion of proper blasting methods. When due precautions are taken, the shooting of coal is safe. But if care is not exercised at every step in this operation a hazard exists—no matter what explosives are used or how they are fired.

It is against this element of danger that we are campaigning—and against which we urge the unremitting vigilance of all coal mining executives.

Do Not "Short Fuse" -- Fuse should be cut long enough for the end to extend well out of the mouth of the bore hole when the primer cartridge is in place.

THE ENSIGN-BICKFORD CO.
SIMSBURY CONNECT

1929

Primacord®

your safest method of initiating explosives whenever stray electric currents may be encountered

This well-recognized hazard is minimized when Primacord Detonating Fuse is used – as the initiator *throughout* the blast.

Primacord cannot be detonated by extraneous electric currents . . . *minimizes the possibilities of premature detonation* from such causes. On at least one occasion, a Primacord trunkline failed to detonate when struck by lightning! This is one important reason why more and more blasters are adopting Primacord for open pit and construction projects . . . and for underground operations. It is of special importance when preloaded techniques must be used.

But *when you are ready to blast*, Primacord provides a continuous line of detonation moving at a speed of almost four miles per second. It has a *minimum* initiating strength of a blasting cap along its entire length. Primacord is relatively insensitive. It cannot be set off by sparks – or by normal vibration, friction or shock. It has the added advantage of being simple, easy and economical to use.

A Primacord downline saves time and labor costs when loading; simplifies multiple priming and deck loading operations. As a trunkline, it will connect all holes for instantaneous or surface delay initiation. Primacord is available in a number of standard and special types developed to meet varying needs. For further information, consult your explosives manufacturer or write

THE ENSIGN-BICKFORD COMPANY
Simsbury, Connecticut • *Since 1836*
THERE IS A TYPE OF PRIMACORD® FOR EVERY TYPE OF BLASTING

E-B

Free! NEW GUIDE AND CONDENSED MANUAL. PRIMACORD DETONATING FUSE . . . WHAT IT IS . . . HOW TO USE IT. ASK YOUR EXPLOSIVES MANUFACTURER OR WRITE US GIVING YOUR COMPANY NAME.

1961

Milestone for Coal Age

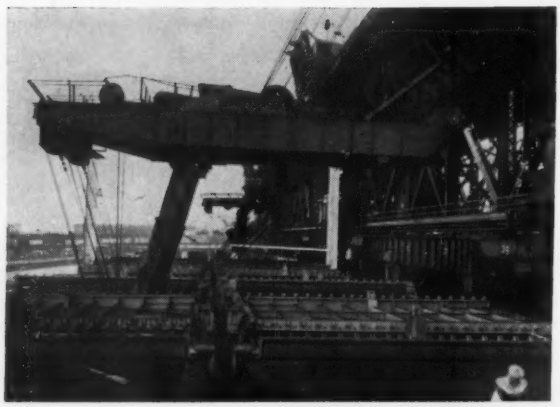
Ensign-Bickford salutes Coal Age on its 50th anniversary. Our company has been privileged to advertise in this leading publication since 1929. The very first ad is reproduced on the opposite page, together with a current one. Both have a purpose in common with Coal Age's objective: *to improve the efficiency and safety of coal mining.* We look forward to many more years of co-operation with Coal Age, contributing to the coal mining industry as it meets the challenge and opportunity of the future.

THE ENSIGN-BICKFORD COMPANY

Simsbury, Connecticut

CELEBRATING IN 1961 • OUR 125TH ANNIVERSARY

In 1836, Ensign-Bickford manufactured America's first safety fuse. Still today, we are the country's leading source. In addition, many new and advanced products have been developed, including Primacord® Detonating Fuse, Low Energy Detonating Cord, and, in the field of space technology, separation and destruct systems for missiles, explosive trains, and other modern pyrotechnical items.



THE RECORD FOR COAL TONNAGE DUMPED INTO A SINGLE SHIP at Hampton Roads was broken for the second time within a month on Sept. 9 when a Greek vessel took 30,833.5 net tons at the Norfolk & Western Railway's Lamberts Point piers, Norfolk, Va. For the first time the railway used a permanent installation which greatly expedites the loading of unusually wide colliers. The "Mando Theodoracopulos," 84 ft wide with a longitudinal bulkhead, was loaded in hatches on both sides simultaneously through the use of a new, extended telescoping chute and trimmer. Photo shows the new loader in the foreground working at an outer hatch, while the conventional loader can be seen also working, center rear. The coal, originating from Virginia mines served by the N&W, was destined for Japan. The previous record for Hampton Roads was set Aug. 12 when the "Morven" took 30,608 net tons at the N&W piers.

ABC gives you the

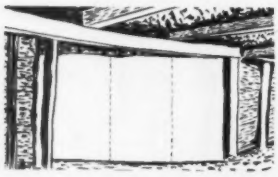
BEST CURTAINS

made from durable vinyl plastics!

These airtight curtains of a tough plastic material, further strengthened by the tough nylon fibers imbedded within the plastic, assure maximum service life and cost less than comparable materials in the long run. Curtains of this material are available in two types—a 12 oz. weight and an 18 oz. weight. Curtains can be made to size to meet coal mine specifications for either solid plastic stoppings or fly pads.

ADVANTAGES:

- Light in weight, yet tough and wear resistant.
- Strong—tear resistant. Can be moved and used over and over.
- Resistant to acids and oils.
- Will not rot or mildew.
- Flame resistant.
- Airtight—no porosity.
- Not affected by moisture—nonabsorbent.



12 OZ. WEIGHT CURTAIN

Yellow for high visibility. A sturdy, economical curtain that is easy to hang. Cannot unravel. Not easy to tear or puncture. Recommended by many mining engineers.

18 OZ. WEIGHT CURTAIN

A clear plastic material. Light can be seen through this curtain. Increases mine safety. More durable than the 12 oz. curtain. Can be furnished with overlapping flaps at center which permit miners or shuttle cars to readily pass through the curtains.

Send for literature and samples

ABC AMERICAN BRATTICE CLOTH CORP.

200 KING'S HIGHWAY
WARSAW, INDIANA

Manufacturers of: Brattice Cloth, Mine Vent and Mine Duct Tubing, Trolley Guard and Powder Bags. Write us for ventilation information booklets.

foam-generating equipment is contained in *R. I. 5632, Controlling Mine Fires With High-Expansion Foam.*

Control of Fires in Inactive Coal Formations in the United States, by F. E. Griffith, M. O. Magnuson and G. J. R. Toothman summarizes the lessons learned while fighting 70 fires in abandoned mines and other inactive coal deposits. It is designed as a guide for public officials, mining companies and contractors concerned with extinguishing such fires. *Bulletin 590. 105 pp. 60¢, Superintendent of Documents, Government Printing Office, Washington 25, D. C.*

Research and Technological Work on Explosives, Explosions and Flames, by R. F. Brinkley and R. W. Van Dolah. I. C. 7998. Fiscal years 1955 and 1956, 30¢. I. C. 7999. Fiscal years 1957 and 1958, 25¢. I. C. 8000. Fiscal year 1959. 30¢. *Superintendent of Documents, Government Printing Office, Washington 25, D. C.*

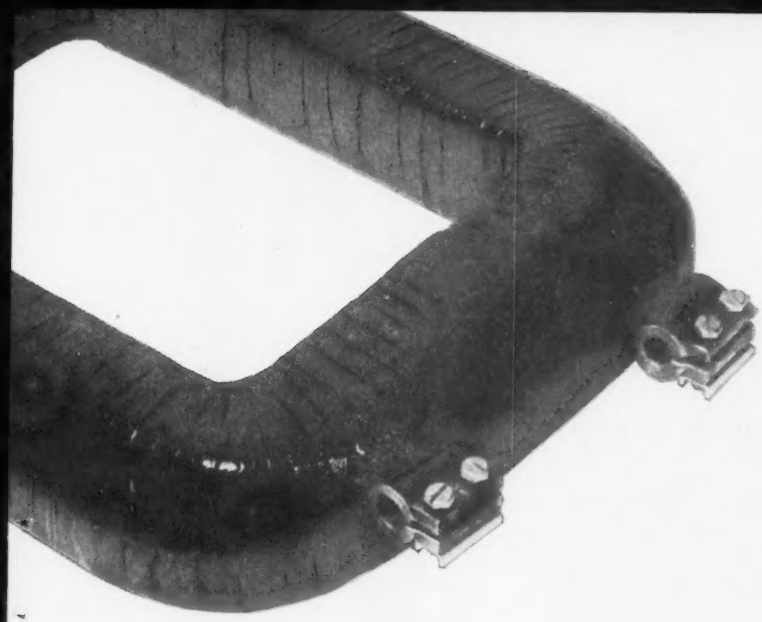
Determining the In-Place Support of Mine Roof With Rock Bolts, White Pine Copper Mine, Michigan, by R. H. Merrill, T. A. Morgan and C. J. Stehlik. This report describes procedures developed by the Bureau of Mines for calculating rock-bolt spacing. *R. I. 5746. Publications-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Ave., Pittsburgh 13, Pa.*

Mineral Laws

Summary of Mining and Petroleum Laws of the World, by Northcutt Ely is a guide to mining and petroleum laws of the world. It is the first of its kind published in a single volume and presents highlights of mining and mineral land tenure laws of more than 100 countries *I. C. 8017. 215 pp. $1, Superintendent of Documents, Washington 25, D. C.*

Preparation

Aufbereitung Oer Steinkohle, by Erster Teil. (In German) Describes various types of screening and preparation equipment. *407 pp. 8½x12-in; cloth. Verlag Gluckauf GmbH, Essen, Germany.*



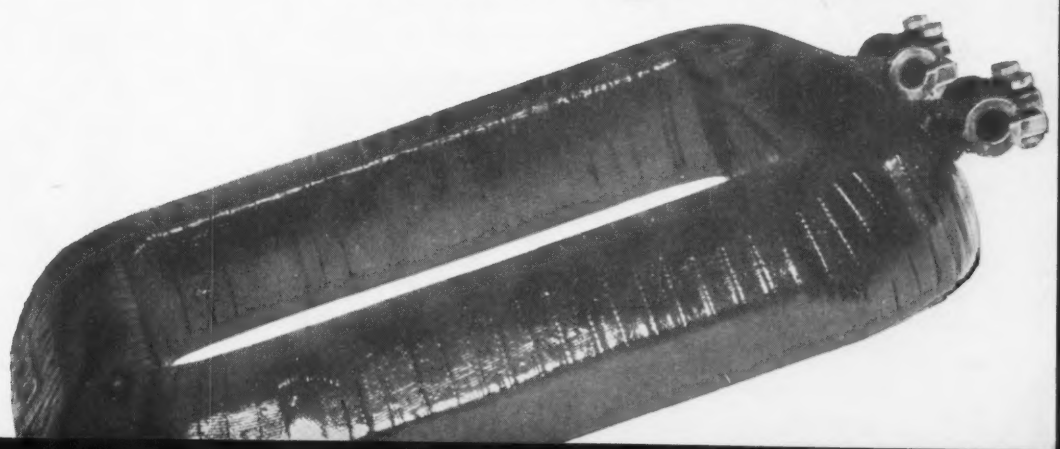
many mine locomotive RENEWAL PARTS may

LOOK ALIKE
FEEL ALIKE
WEIGH ALIKE
FIT ALIKE

BUT they don't perform alike. Only General Electric certified Renewal Parts are designed to maintain the perfect balance of the entire mechanical and electrical system of a General Electric mine locomotive. System design and craftsmanship assure that each part does its job efficiently and effectively . . . and makes a positive contribution to every related part in the system. Since each G-E part is made specifically for General Electric mine locomotives, there is no need for design compromise. Proper system performance will save your maintenance dollars.

For information on parts and maintenance problems contact your local G-E sales representative or write to General Electric Company—Locomotive & Car Equipment Department—Building 12—Erie, Pa. 121-05

GENERAL ELECTRIC



KEEP JOBS MOVING WITH THERMOID BIG T CONVEYOR BELTS... ABOVE OR BELOW GROUND, THERMOCOAL BELTS COST LESS PER TON OF COAL MOVED

Thermocoal plied belting with step-back, Coledge construction, in installation after installation moves coal at a lower cost per ton than any comparable belt.

WHY?

- Thermocoal belting is pre-stressed during manufacture to eliminate in-use stretching.
- Plies are thoroughly impregnated with flame-resistant neoprenes and separated with skim coats to provide superior flexibility and greater impact resistance.
- Tough, nylon breaker strips give extra protection against gouging, provide better bonding of carcass and cover.
- Exclusive Coledge construction puts extra rubber at the edges for edge-flexibility and wear resistance.

Flame-resistant Thermocoal meets USBM standards, and is available in 4-5-6 ply cotton or cotton-nylon-duck construction particularly suitable for long spans and tough, abrasive usage. In Victor (natural rubber) and Ebonite (GRS) grade covers.

Call your Thermoid Big T distributor today to help you select the best Thermocoal belt for your coal handling requirements. He also handles other Thermoid belts and industrial hose to handle any job.

Quaker Thermoid

EXCLUSIVE "COLEDGE" CONSTRUCTION—Plenty of rubber where it counts—Stepped back plies make edges more flexible. Result!—Thermocoal rides with the punches when it contacts frame members, lasts longer!

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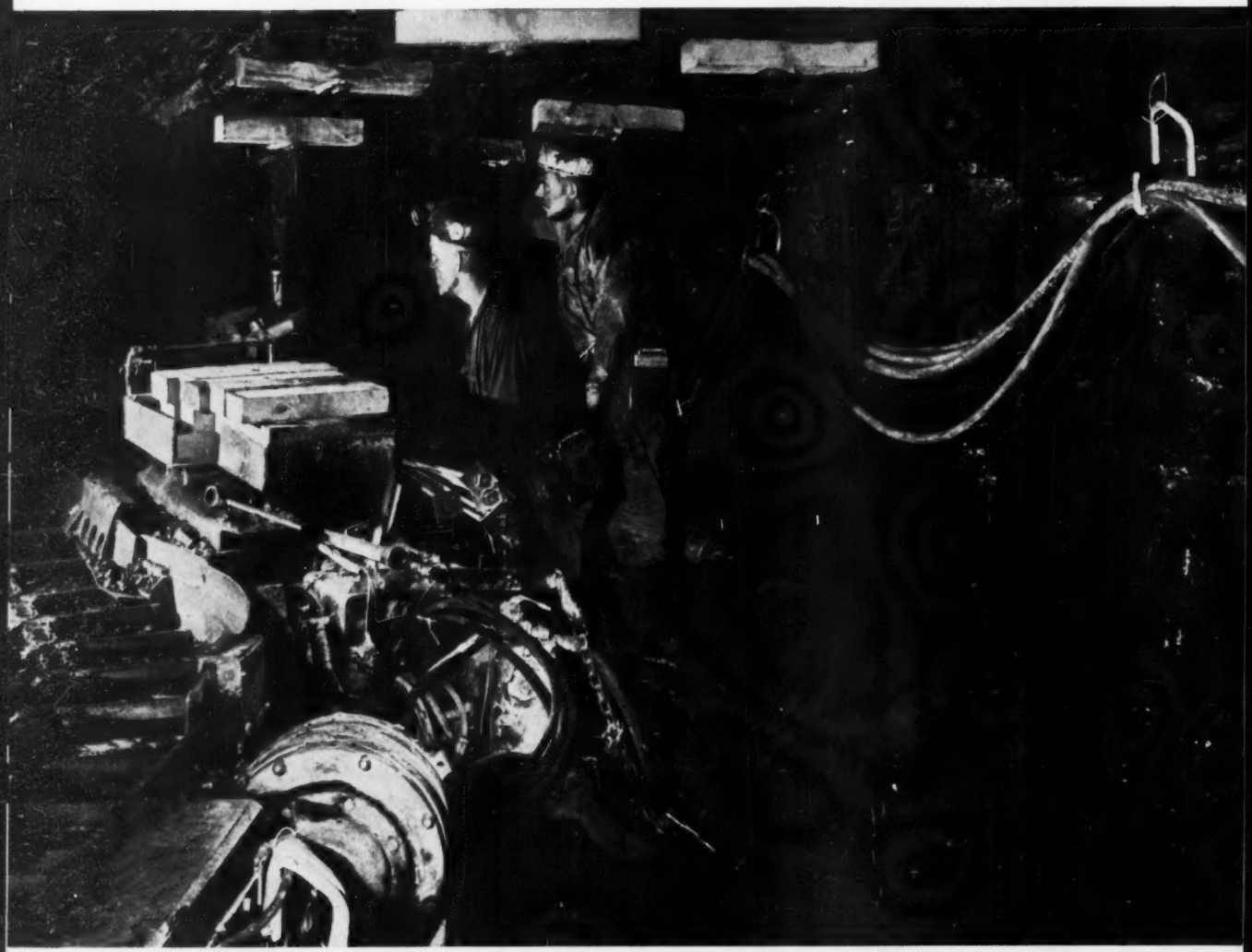
THERMOID DIVISION
H. K. PORTER COMPANY, INC.
200 WHITEHEAD ROAD, TRENTON 6, NEW JERSEY

National Electric is the *Speedy* way to put power in place

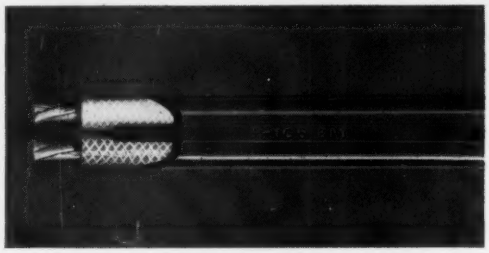


National Electric trailing cable on a continuous miner at Warwick Mine No. 2, Duquesne Light Company, Greensboro, Pa.

National Electric mining cable has been used in this mine about five years. Three shifts produce about 4,000 tons a day from the Pittsburgh Seam. This is the kind of service that has proved National cable to be dependable—durable—flexible.

National Electric has a complete line of mining machine cable types and sizes. Manufactured in the heart of the coal mining industry, National Cable can be shipped to you in a hurry. And, when you need personal service, a National Electric Sales-Engineering Representative can get there fast. Why don't *you* try National Cable?

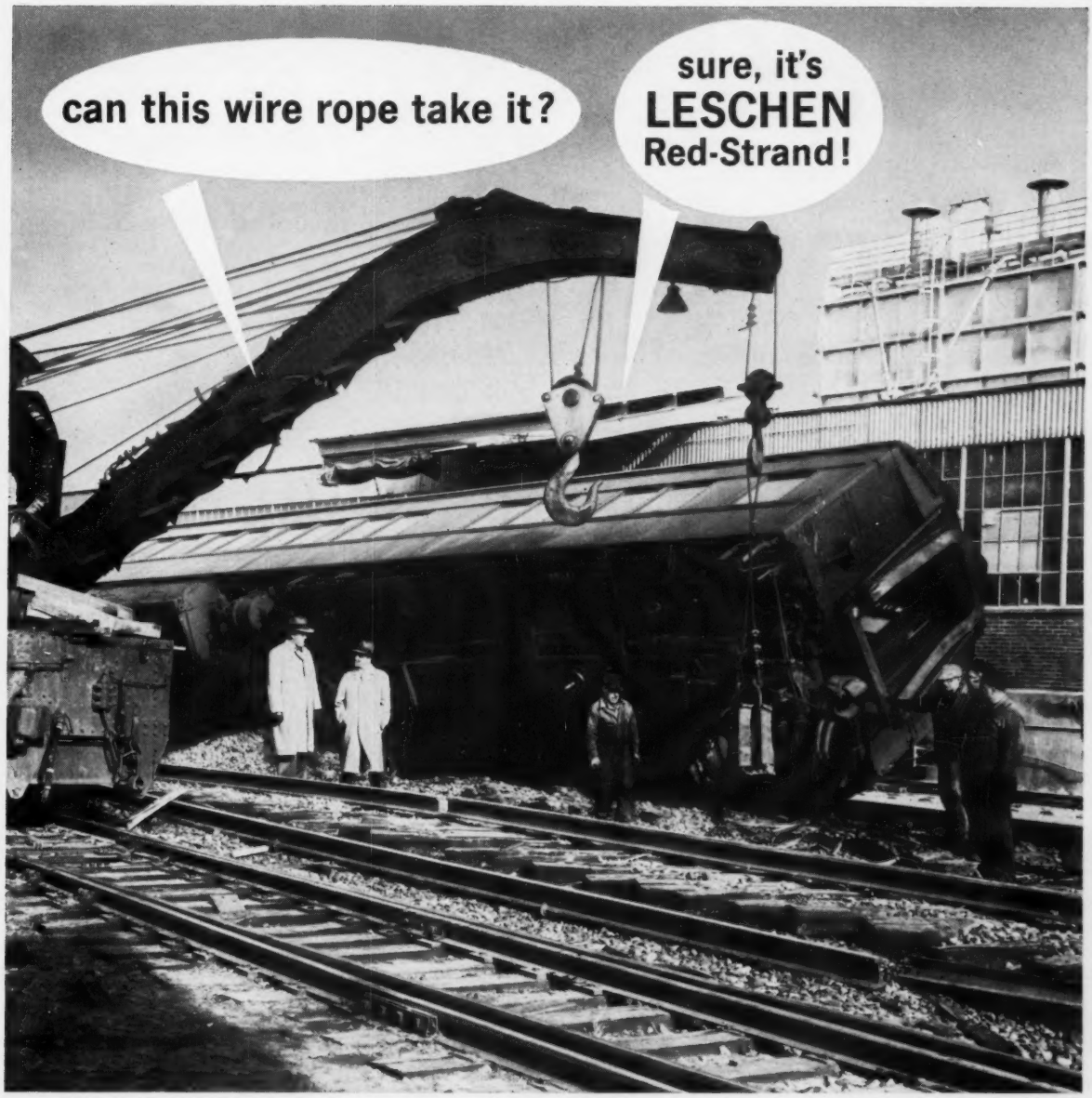
Write for Catalog 702 . . . ask your NE Representative . . . or call National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pa. EXpress 1-1800.



National Electric's new "Indestructo" mining machine cable . . . first introduced at this year's Coal Show.

PORTER

NATIONAL ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.



You are on the right track here. For the big lifts or ordinary loads Leschen Red-Strand is universally accepted and demanded by wire rope users who expect and get their money's worth. • Constant research and development have provided Leschen users with a complete range of sizes and types for every conceivable task. This versatility, backed by Leschen's distribution and technical services, is your assurance of wire rope dependability for every job. • *Accept nothing less than Leschen.* For the name of your nearest Leschen distributor write: Leschen Wire Rope Division, H. K. Porter Company, Inc., 2727 Hamilton Avenue, St. Louis 12, Missouri.

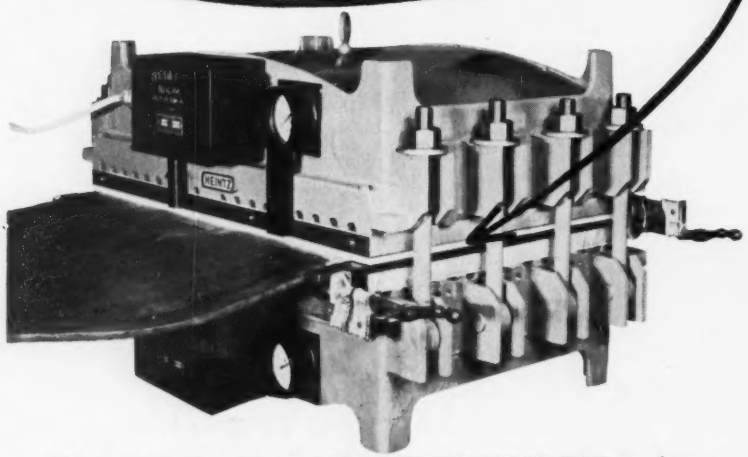
PORTER **LESCHEN WIRE ROPE DIVISION**
H. K. PORTER COMPANY, INC.

THE STONEGA COKE & COAL CO. Barbecue Picnic for members of its mine management and department heads took place at the Lonesome Pine Country Club near Norton, Va., on Sept. 9. Including guests, 189 attended the festivities. After an address of welcome by W. C. Schott, vice president, the day's activities got underway under the direction of Master of Ceremonies T. J. Liddle, director of safety. A high spot of the picnic was the presentation of National Safety Council Awards to superintendents and section foremen by C. H. Hagy, vice president and general manager.

IMPROVE your Vulcanized belt splices and repairs

with the new

HEINTZ CONTOUR PAD



The specially compounded HEINTZ CONTOUR PAD conforms to uneven belt surfaces . . . .

GUARANTEES adequate pressure over entire area covered.

ASSURES even flow of new rubber.

ELIMINATES ragged, spongy spots caused by uneven build-up.

Available for all widths of belts vulcanized in all models of HEINTZ vulcanizers . . . .

Write for complete information . . .

State belt widths and HEINTZ vulcanizer model numbers.

A COMPLETE LINE OF EQUIPMENT IS AVAILABLE FOR EVERY BELT SPLICING AND VULCANIZING JOB UP TO 100 INCHES OR MORE IN WIDTH.

HEINTZ *Manufacturing Company*

13110 Enterprise Avenue Cleveland 35, Ohio

Equipment Approvals

Lee-Norse Co. — Model CM32Y-1E continuous miner; three motors, each 75-hp, 440-V, AC. Approval 2F-1671A, Aug. 8.

Joy Mfg. Co. — Type 15BU2-1BH loading machine; seven motors, four 25-hp, two 15-hp, and one 6-hp, 440-V, AC. Approval 2F-1672A, Aug. 14.

Allis-Chalmers Mfg. Co. — Model TL-14DA diesel tractor powered by Allis-Chalmers Model D-273 diesel engine with Fate-Root-Heath EX5002 exhaust-gas conditioner, for use in noncoal mines. Approval 24-43, Aug. 16.

Joy Mfg. Co.—Type 18SC8PE/PXE-1 shuttle car; five motors, two 25-hp, two 10-hp, and one 15-hp, 250-V, DC. Approval 2F-1673, Aug. 23.

Wise Coal & Coke Co. — Type RBD-7, MS-14 roof-bolting machine; one motor, 15-hp, 440-V, AC. Approval 2F-1674A, Aug. 25.

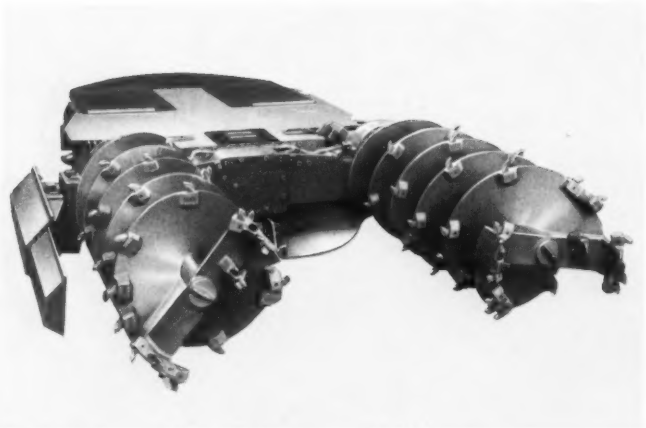
Galis Electric & Machine Co. — Model 320 roof-drilling machine with integral dust collector; one motor, 20-hp, 550-V, DC. Approvals 2F-1527A and 25B-90, Aug. 28. (Approval 2F-1527 covering the 250-V, DC, Model 320 roof-drilling machine was issued to Galis Jan. 18, 1960.)

Wilcox Mfg. Co.—Model Mark 20-D continuous miner; four motors, two 60-hp, one 10-hp and one 7-hp, 240-V, DC. Approval 2F-1675, Aug. 31.

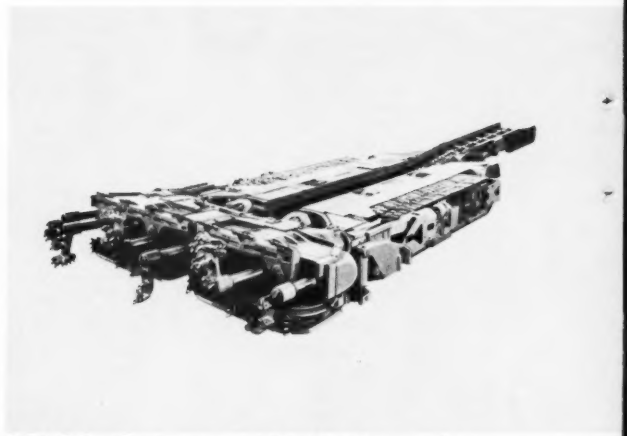
Goodman Mfg. Co. — Type 428 borer; two motors, each 250-hp, 440-V, AC. Approval 2F-1676A, Aug. 31.

MORE TONS PER MAN..
MORE PROFIT PER TON..
WITH PERFORMANCE-PROVEN
JEFFREY CONTINUOUS AND CONVENTIONAL MINING EQUIPMENT

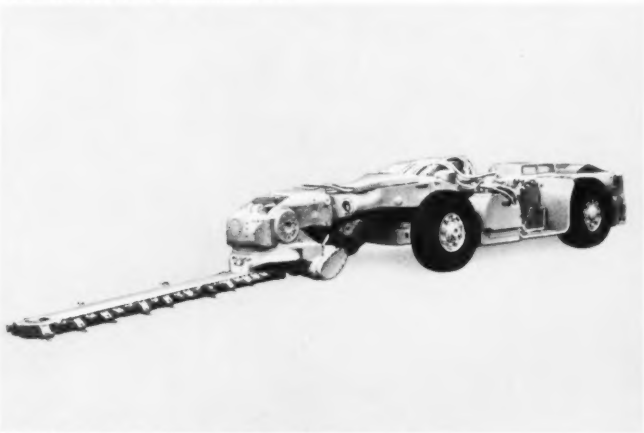
STANDARDIZE ON JEFFREY CONTINUOUS AND CONVENTIONAL MINING EQUIPMENT FOR GREATER TONNAGE... HIGHER PROFITS!



100-L Continuous Miner — A low-seam unit for low initial investment, minimum cost.

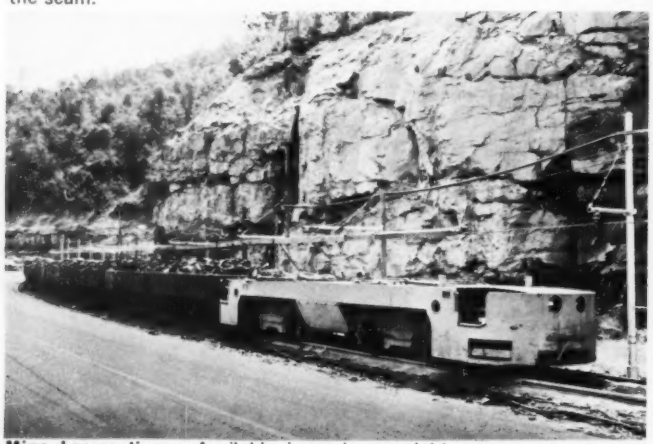


86-A Colmol® — Low-seam, high capacity, crawler type machine that increases production rates.



70-UR Universal Coal Cutter — Cuts any place in the seam.

56-RDR2 Drilling Machine — Equipped with double drilling arms to speed-up roof bolting operations.



Mine Locomotives — Available in various weights up to 50 tons.

Aerodyne Fans — Built in sizes to deliver up to 500,000 C.F.M.

Shown below is part of Jeffrey's complete line of precision-engineered mining units available to meet your mining requirements.

Continuous Mining Units provide excellent, full seam mining performance, with significant operating economies.

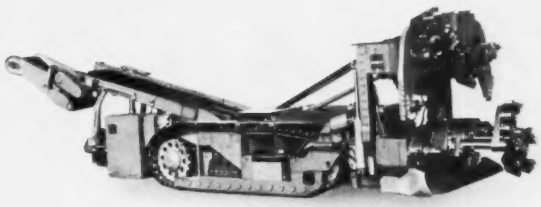
Conventional Mining Equipment is both versatile and economical . . . gives efficient high-speed production.

System Planning is available from competent Jeffrey sales engineers. They'll be happy to analyze your requirements . . . recommend an integrated Jeffrey system to meet your specific operating requirements.

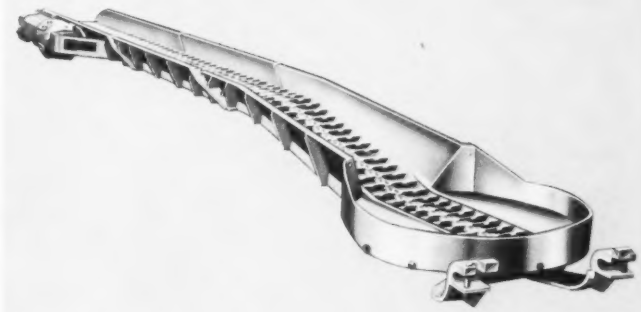
For Complete Information send for any of the catalogs listed on the next page or contact the Jeffrey mining office nearest you.

If it's conveyed, processed or mined, it's a job for Jeffrey.

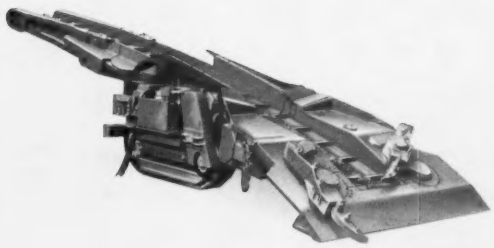
JEFFREY



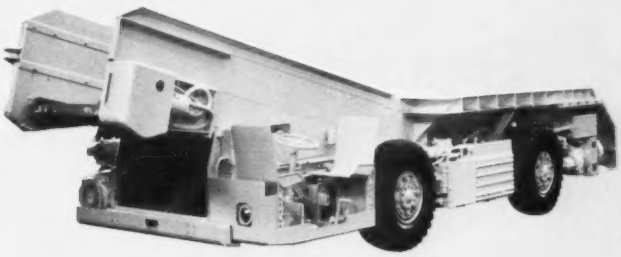
76-CM Colmol — Designed for mining seam heights from 67 to 96 inches.



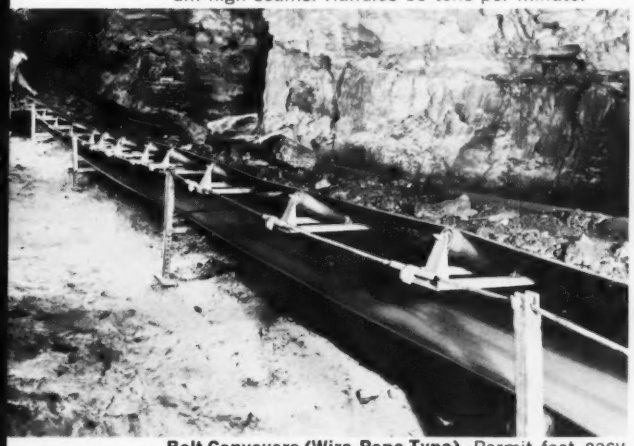
94-B Bridge Conveyor — Couples directly to the discharge conveyor of the Colmol or Loader.



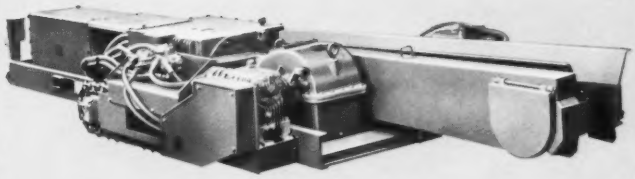
81-A Crawler Loader — Designed for mining medium high seams. Handles 10 tons per minute.



66 Shuttle Car — High-capacity cars built in heights from 30 to 48 inches.



Belt Conveyors (Wire-Rope Type) - Permit fast, easy extension or retraction.



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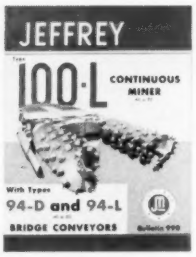

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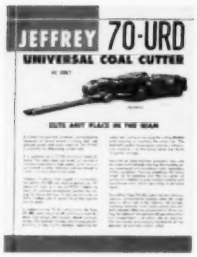

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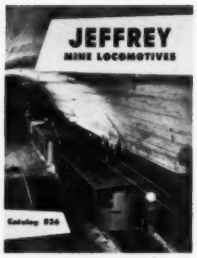

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COAL AGE OCTOBER, 1961 IVAN A. GIVEN, EDITOR

GOLDEN ANNIVERSARY ISSUE

The Coal Future . . . And Its Challenge

It is literally true that now, in 1961, coal has emerged from one era of major significance in its history lasting almost exactly a half a century, and is moving into another equally or even-more significant. In the past half century competition reached full bloom, and increased utilization efficiency—though welcome as a means of holding the market —also took its toll of tonnage.

The results all coal men well know. Bituminous growth was arrested, except for wartime booms, and anthracite was thrown into a decline that may yet go on a while.

Now, bituminous is heading into an era of renewed growth, and there is cause to believe that anthracite may have a chance to at least stabilize in the not-too-distant future.

The challenge of the coming growth era lies in attaining the maximum in market possibilities, which in turn means the maximum in tonnage and profits. The era on which coal is now embarked will bring perhaps the ultimate in laborless production and preparation, and thus will enable coal to continue to offer a Btu bargain no other source can even approach let alone match on an economic basis. But meeting the challenge of attaining the maximum in sales, growth and profit will take more than a superior production and preparation accomplishment. It will require full and faithful application of all the other principles and policies governing marketing and market development, relations with the public and government, enhancement of employee-union cooperation, and the development of additional sources of income and profit.

The challenge is major and the job is big. But it can be done and the rewards in profit through the best in service to the Nation can be equally big.

A Program For Coal

Directed to . . . Maximum Sales and Profits In the Growth Era Ahead

GROWTH is in the bituminous future. That all agree on. The differences arise when it comes to how much growth. But even the most conservative of forecasters will agree that the maximum—whatever it may be—can be attained only if the industry adopts and religiously follows policies that will result in maximum leverage in the marketplace.

Few new policies, as a matter of fact, are needed. The guideposts for coal have long been in place. The policies for coal strength have been discussed and to a considerable extent followed for many years. The big thing is to get maximum acceptance. As its contribution to that end, *Coal Age* offers the following "Program for Coal," distilled from years of meetings with mining and marketing authorities and its own studies and conclusions as set forth in the various features in this Golden Anniversary Issue—dedicated to helping the industry get set to meet "The Challenge of Coal's New Growth Era"—an era providing major new opportunities for progress and profit through improved product and service.

Achieve the Right Management Approach

IN GETTING the most out of the opportunities that lie ahead for coal, it is not enough, though it helps wonderfully, to have only a low cost or a high-quality coal, or both. Nor is it sufficient to be a whiz at marketing without the quality or price.

Efficient management now and in the days to come must give the proper weight to all the factors that combine to build up the acceptance of the product. It cannot afford to neglect sales, for example, to concentrate on cost. Action on the sales side may be only that of selecting a good agent and then checking from time to time. But that action must be taken and should be taken only after careful consideration of the candidates to make sure that this vital operation is placed in as competent hands as possible.

Equally important are the proper actions in the areas of production, preparation and related activities because the marketing impact eventually is the sum of actions on all the fronts—production and preparation, as well as sales. Top management's first job, therefore, is to check on its own approach to the overall task. The aim is to make sure that everything is done that should be done, and at the same time that one activity is not stressed at the expense of others that are also essential—and more important at the cost of a weakened total impact at the point of sale. In the still-competitive days ahead, with rising investment costs and harder battles in the marketplace, the premium on managerial skill will be greater than ever—and with it the rewards.

Really Know The Market—Actual and Potential

THE MAXIMUM in sales—and with it the maximum in production, income and profit—comes only when market possibilities are fully exploited. This means that they must be known in full detail. This includes prospects as well as customers already on the books. Not every prospect is worth trying for, but if nobody knows about a potential customer he can't be sold.

One of coal's big weaknesses of the past has been lack of market research on either the individual-company or industry levels. There is still room for improvement. In the areas which coal can reach it should know every user of every type of fuel—and it should keep abreast of plans for new installations so that it can get in on the ground floor before another fuel wins by default.

The better road to increased business lies in creating new demand by knocking competition out of both existing and new facilities, rather than uneconomic battling for the tonnage already in existence. Intensive market research is the first step.

Really Know The Buying Influences

BUSINESS IS NOW—and always will be—done with individuals. Sooner or later, therefore, some man or group of men will say "Yes" or "No" and thus determine which seller gets the order. "Buying influences" is the fancy designation for these men, who either recommend or make the final decision. The more of these buying influences that are known, reached and convinced, the easier the sales job becomes. Thus, along with really knowing all the present and potential coal-burning installations it is vital to know the names and reach the men who can influence or decide what fuel will be used.

Really Know The Competition

THE AVERAGE COAL MAN probably firmly believes that he knows the competition. It walks in and takes the business—usually unfairly he is inclined to think. In some cases he is right. But is that all? Competition has strong points, which it naturally emphasizes. And it has weak points, which it naturally tries to sweep under the rug. What are these weak points? And will some of the strong points, such as, price, convenience and the like, weaken or disappear? And so on.

It is axiomatic that getting maximum results in a competitive situation requires knowing the competition even better than it knows itself—or at least as well.

Invest for Profit

IT IS LITERALLY TRUE that spending money is the way to make money in coal mining—that is, of course—if the money is spent wisely. The big goals are (1) reduction in the cost of production and (2) enhancement of quality.

The fact that mine prices today are less than they were 10 yr ago and quality is up is one of coal's biggest weapons in the battle for the tonnage markets. And it is an equally cheering fact that good profit margins can be attained at these reduced prices. In fact these improved margins are a direct result of the gains made on the cost side of the ledger. Even more cheering is the fact that coal still has an impressive margin to work on. In other words, the labor content of some mine prices is today only 20 to 25%, compared to the average of around 40 to 45%. So coal should be able to maintain present price levels or possibly even reduce them in the years immediately ahead. For competition, there is no such opportunity—only continued increases in their costs and prices.

A modern equipment-investment policy also should contemplate the expenditures that may be necessary to cut breakdown time and repair costs. Real maintenance savings can be attained and real production increases achieved.

Staff and Train for Efficiency

IN ALL PROBABILITY the greater coal production of the future will be attained with fewer men. Certainly the trend is downward. But if the number of miners—and possibly supervisors—is to be less, the quality, in contrast, must be much higher. The investment in production equipment and preparation facilities is too great for any but the best even now—and this investment will reach even higher levels in the future—up to $1 million or more for a robot mining unit and $12 million or more for the new super-giant stripping units.

The supervisory, operating and maintenance manpower required for such investments cannot be picked up off the streets. The job will require scientific selection backed up by real training either before or after the man goes on the payroll.

Press Equipment And Methods Development

HYDRAULIC MINING and pumping of coal from the face to the preparation plant—or even directly to the ultimate consumer—may not come to pass in coal, but they are examples of some of the hitherto-untried ideas for producing and handling coal at higher efficiency and lower cost. And aside from new ideas—both those already suggested or to be dreamed up in the years to come—it is quite evident that major improvements can be made in what might be called conventional equipment, with equal improvements in the systems of using it in mining, transportation and preparation of coal.

Mining research shares with utilization research the dubious distinction—so far—of a stepchild status, even though progress has been made. However, research still has not achieved the status it should have for maximum effectiveness.

Employ the Modern Operating Aids

CAN ONE MAN with pencil and paper figure out when to use two shuttle cars and when three—and what happens if he changes room and crosscut centers—that is, can he do it without an inordinate expenditure of time and money and even then be sure he is right. Or can that same man arrive at the best size mix from a preparation plant in relation to market conditions at that moment? Or the proper level for the parts and supply inventory? Or can a face foreman just by walking around and using his best judgment, determine where he is losing tonnage and what he should do about it?

Experience has proved that men—no matter how able—find it difficult to come up with the right answers, aside from time and money considerations, without special equipment, techniques and training. The answer is maxi-

mum possible use of modern facilities and ideas. They include industrial-engineering principles, operations research and, among other things, computer computation and data processing to arrive at such answers as the proper mining setup for a given equipment unit, the product mix for a given market situation, the proper inventory level and—vital to precise control over operations and cost—accurate and immediately available records and reports for management.

Step Up Equipment Utilization

MACHINE COST is now a big item in coal mining. It will continue to grow—perhaps even overtaking labor cost in the not-too-distant future. This is not an indictment of machine prices. On the contrary it is a reflection of the fact that it is necessary to step up investment cost to reduce labor content and keep prices down. So far, and for quite a while to come, the savings in labor exceed the increase in machine cost by a wide margin. However, the rise in the latter does make it mandatory to utilize the machines more hours per week and thus get the maximum output per dollar of investment. A schedule of 168 hr per week probably is unrealistic, but the 135- to 140-hr schedules normally prevailing for big stripping units certainly can be set down as possible goals. This will mean in turn, among other things, design and construction for all equipment corresponding to that of the big excavators, as well as the same maintenance practices.

Really Drive For Safety

IF THE "NATURAL HAZARDS" of the industry were the sole causes of injuries and fatalities in coal mining, the number of such injuries and fatalities would be down very materially from its present level. Part of the answer to achieving the irreducible minimum could lie in the development of new equipment and methods. The robot miner, the auger and similar machines mean, for example, that men have to go under but a fraction of that part of the roof where the support is the chanciest and the hazard is the greatest. Now, the big part of the underground employees must constantly operate under roof of this type.

But the human factor must still be reckoned with after equipment and physical factors are taken care of. The big reason for injuries and fatalities is the fact that men still take chances. Eliminating the chance-taking philosophy remains one of management's—and the union and government's—big jobs for the future, along with the other measures to reduce the accident toll.

Push for Higher Quality At Lower Cost

THOUGH THE RAW-COAL CONCEPT could find wider acceptance in the future in certain markets—the utility in particular—under certain conditions, it can be assumed that for quite a few years to come most of the coal will be used at points away from the mines, meaning that freight on waste material will continue to be a significant factor in consumer reaction. Also, the noncoal material will continue to be of concern in such processes as smelting iron ore. Further, among other things, the passage of time is not likely to diminish the value of uniformity to the consumer.

With rare exceptions, therefore, low-moisture, properly sized coal with minimum impurity content consonat with cost of preparation will continue to be an asset in marketing for a long time to come. And with attention to providing the customer with this premium fuel should go attention to automating processes and plants, and to other actions that will keep the cost of preparation and loading to a minimum.

Work on Mine-to-Market Transportation Costs

NEXT TO REDUCING labor content, cutting mine-to-market transportation costs offers one of the best opportunities for attaining new lows in delivered prices, and at the same time new highs in competitive strength. The opportunities are not nickel-and-dime but rather the potentials are in dollars. Coal is doing part of the job and the carriers part. Certainly coal should lend its best efforts to help the carriers get their charges down—at the same time not neglecting original research and development on its own to supplement the work of the independent transportation organizations of all types.

Step Up Research To Build Markets

ANYWAY YOU SLICE IT, and in spite of the fact that the volume of work has been stepped up over the years, research to expand existing coal markets and create new ones still is far short of what it should be. The primary responsibility is on coal itself, though it naturally should encourage supplementary work by others when it is logical for them to do it. But coal cannot ask the independent organizations to carry more than a certain proportion of the load, and it should take steps to shoulder its share immediately. There should be no delay in getting an appropriate full-scale program under way.

"An appropriate full-scale program" means adequate financing. Acceptance of this view means facing up to the fact that much-greater support must be provided to insure that research can deliver.

Push Equipment To Use Coal

THE RELATIONSHIP of equipment availability to sales opportunities for coal still is not fully appreciated even though more than a fair share of coal's modest research budget has been devoted to its development. It is only recently that coal has had equipment to match and exceed the packaged oil and gas units so widely employed in general industry and commercial establishments. Coal needs to really work with and assist established equipment organizations in developing, selling and servicing modern coal units. It also should be prepared, if necessary, to sell and service on its own account if progress is slow in other directions.

The prize in equipment development and in pushing its sale is quite a few million tons coal could—or could not—enjoy. Action is needed now.

Sell Hard and Improve Service

A QUALITY PRODUCT and a competitive or better-than-competitive price are two of the three key ingredients in business that stays put. The third is selling itself, supplemented by service that reduces trouble, helps the customer operate more efficiently, and keeps him coming back. The best in salesmen and service men is the first essential. The next is equipping them with the right tools and then backing them up and paving the way by advertising and all the other forms of promotion that induce buying influences to stop and listen when the salesman makes his approach.

Hard selling and the best in service mean the maximum in tonnage booked—and held.

Diversify and Integrate

SOME EVIDENCE of a modest trend toward diversification already is apparent in coal—in the majority of instances based on utilizing a waste by-product, such as, refuse for lightweight aggregate or the production of alumina. There also are examples of reverse diversification where coal companies have been bought by outside concerns in totally different lines. Perhaps coal companies can reverse the reverse and take on other businesses.

Integration in the form of owning coal-processing or using concerns is as yet rather small-scale in coal, though a number of companies have taken the first step of setting up or acquiring distribution organization. Recently also, there have been several plants built by coal companies to produce coke for sale, which is another form of integration toward the point of consumption—and another opportunity for a profit. For the future, the big opportunities will lie in synthetic liquid-fuel and gas plants.

Press the Fight For Fair Treatment

AS ONE OF THOSE INDUSTRIES that has experienced more than its share of direct-government or subsidized competition, discrimination in purchases, taxes and the like, and dumping and other unfair competitive tactics, to name but a few, coal has a keen awareness of how extensive unfairness can be. It of necessity has had to develop some skill and determination in battling back. The need for effort along these lines will be no less in the future.

The big battlegrounds are Congress and the federal administration, but depending upon the particular question and the circumstances, the general public, industry in a certain area, state legislatures, and even local governments may be involved. Coal must be prepared, individuals as well as the industry, to move on any of these levels.

Enhance the Industry Image

THE PUBLIC IMPRESSION of an industry now is summarized by the word "image," and coal has no less a job than other industry in making its image shining and keeping it that way. The job ranges all the way from neatness at the mine and being a good neighbor in the community to national campaigns to create interest in and appreciation of the industry and its contributions to the general welfare. This is a continuing task.

It is a task not only for industry organizations, but also for coal companies and, even, individuals. All can do a job—sometimes together and sometimes separately—depending upon the particular situation and problem, whether of a national nature, such as advocating Congressional study of the desirability of a "National Fuels Policy;" or of a local nature, as extinguishing a gob-pile fire at the mine.

Cement Employee-Union Relations

IT HAS BEEN A LONG ROAD to today's era of calm, lack of controversy and cooperation in management-miner-union relations, though it perhaps still cannot be said that Utopia is at hand. But cooperation rather than conflict has been proved to pay off. Every effort should be made to preserve and enhance the present spirit of cooperative effort for mutual benefit through maximum industry progress.

The job involves action not only on the national level but also on the mine or local, because ultimately cooperation at the mines insures cooperation for mutual benefit all up the line. Cooperative action is a practical method of exerting maximum effort to insure maximum sales in the days ahead, since competition will still be around to be reckoned with.

The Growth of Prosperity in the U. S.

	1910	1960	2000
Total Population	92.4	180.7	382.0
Total Labor Force	39.6	73.1	151.0
Total Employment	35.2	66.7	143.0
Hours Worked Per Week	52.0	39.5	32.0
Output Of Goods And Services Per Man-Hour	$ 1.28	$ 3.68	$ 10.85
Total Annual Output Of Goods And Services	$ 122.0	$ 504.4	$2580.

Source: McGraw-Hill Dept. of Economics. Population, labor force and employment in millions of persons; annual output of goods and services in (1960) dollars of real purchasing power.

The U. S. Economy

50 Years of Growth . . . And the Outlook to 2000

McGraw-Hill Dept. of Economics

BY ANY STANDARD of comparison, the American economy has prospered in the past half century. More than 180 million people lived in the United States in 1960—nearly double our 1910 population—and people are living much better now than they did 50 yr ago. Annual production of goods and services has risen to a level more than four times as high now as in 1910, far outpacing the rise in population.

Along with growth has come change—the most certain thing in any forecast of the future. People have migrated from the East to the South and West, with industry following the same path to capture new markets and to provide new jobs. Old ways of doing things have changed and the products consumers and industry use are vastly different from what they were in 1910. The automatic washer has replaced the scrub board, and the airplane has stolen transcontinental passengers from trains.

People on the Move

During the past 50 yr farmers have scrambled off the farms and into cities and their satellite suburbs. Only 8% of our total population is now on the farm, compared with 30% half a century ago. For the most part, the migration of farmers has improved their incomes and their standard of living.

Another significant change has been the exodus to the suburbs, particularly in the last decade. Between 1950 and 1960, population inside central cities increased about 2% while the population of the suburbs around those cities swelled 25%. Only a decade earlier, 1940-1950, the central city showed a healthy population increase (14%) although even then the suburban population was growing more rapidly. In the years ahead, growth in suburbs close to cities will probably slow down. But the overall trend is still likely to be away from the cities to more rural areas where land is still available.

The shift from taxicabs and apartments to crabgrass and commuting has brought new opportunities and new headaches for all types of businesses. Big downtown stores which were quick to sense the outward move entrenched themselves in prime locations outside the city and continued to capture consumer dollars. Nearly every family that makes the outward trek from the city is a boon to the durable-goods industries. In the city housewives frequently use washers in the apartment house laundry or send their wash out. But in the suburbs a washer and dryer

are a must, to say nothing of a car for hauling groceries from the market and taxiing dad to the station each morning.

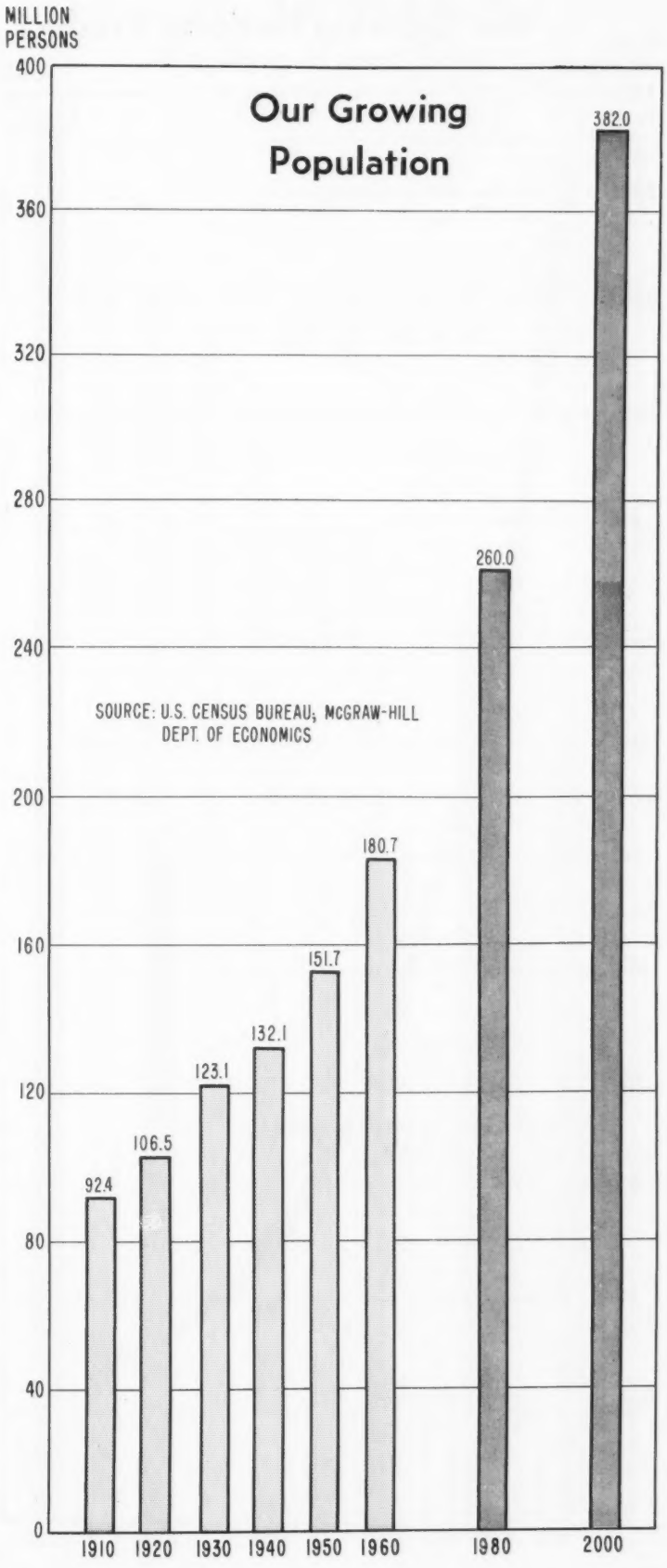
Consumer Incomes

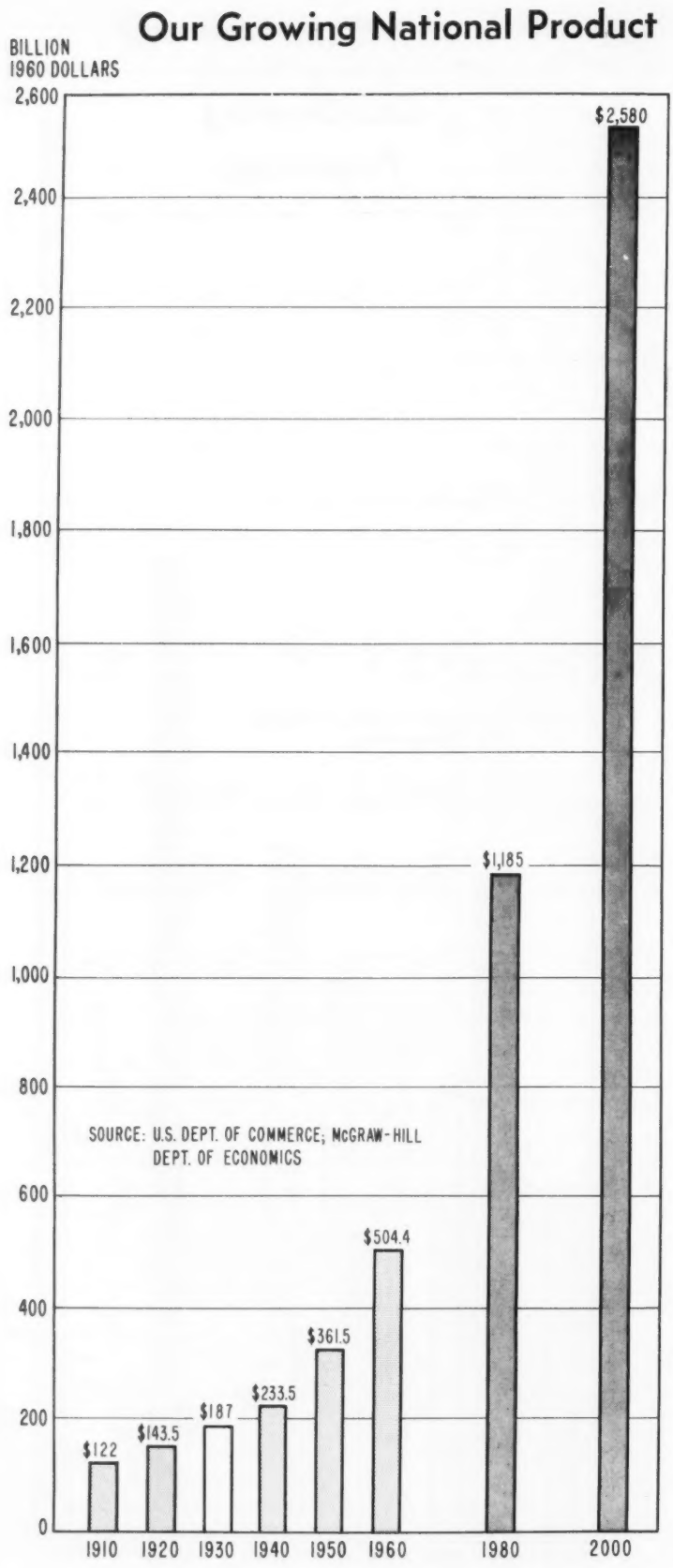
Population growth in the past half century has been accompanied by an enormous increase in real income per person. In 1960 income per capita (total personal income divided by population) was about $2,200 per person, a gain of 90% since 1910.

In addition to growing purchasing power per person, there has been a change in the way purchasing power is distributed in the population. In 1910 most families in this country had incomes of $3,000 or less. A chart of income distribution for that year looks like a pyramid, with most people at the bottom, in the low-income strata, and only a few families in the middle- and upper-income levels. Today, the pyramid is upside down. More families earn $5,000 and over than earn less. The middle class—a very prosperous middle class—has grown while the proportion of very rich and very poor has declined.

Arthur F. Burns, former chairman of the president's Council of Economic Advisors and now director of the National Bureau of Economic Research, sums up this: "Few Americans . . . are aware of the transformation in the distribution of national income that has occurred within the past 20 yr.—a transformation that has been carried out peacefully and gradually but which may already be counted as one of the great social revolutions of history."

The facts of life indicate that the old adage, "The rich get richer and the poor get poorer," has been replaced by "More people are getting richer and fewer are staying poor." The statistics on this phenomenon are really a bit startling. Despite a growing population, the number of families earning under $6,000 per year has fallen from 21.8 million in 1955 to 18.2 million in 1959. In the same intervals the number of nonfarm families earning between $7,500 and $10,000 per year rose from 4.5 million to 8.1 million. In addition, the number of nonfarm families earning more than $10,000 per year has risen from 4.8 million





in 1955 to 7.1 million in 1959. True, we have had some inflation since 1955, so we would expect all families' incomes to rise slightly. But by no stretch of the imagination can those enormous shifts be attributed solely to inflation.

From a nation of "have nots" in 1910, we have improved our standard of living until today Americans have the highest standard of living in the world. Clearly we are an "affluent society." More than 40 million U. S. families own autos, with 10 million owning a second car. Nearly 34 million families own their own home, with 2 million owning a second home. Nearly every family with an electrically wired home has a television set, a radio, a refrigerator and a washer. The abundance of goods with which we are now saturated raises some problems for the immediate future, but over the long run the odds are that the gap between our standard of living and that in any other nation in the world will continue to grow.

The decades ahead will see a continuation of past trends in family incomes with important implications for future consumer markets. Consumers are the most important single purchasing force in the economy and they will continue to spend more each year through the years ahead. Shifts of income distribution toward the middle and a rising average income are important in insuring that the consumer will buy more and better grade goods and services.

Industry on the Move

In the past half century American industry has been about as footloose and fancy-free as the individual. New England, and the Middle Atlantic States, once the nation's industrial core, have declined from their former leadership, while the Midwest and the Far West have grown to maturity. More recently, industry has been building up facilities in the South and West at the expense of the Midwest, although the eventual impact of the St. Lawrence Seaway could reverse that trend.

Surprisingly enough, industry has not been shunning cities on its march to the West. Many sprawling western cities chalked up impressive gains in factory employment while the opposite was true for most East-

ern cities. Typically, newer cities occupy a large area of ground that enables an incoming industry to have some of the benefits of both suburb and city, but there is considerable evidence to suggest that the public facilities needed to attract industry—fire protection, ample water and sewage systems, and transportation facilities—are more often found in cities than in their suburbs.

Barring a major war, which of course affects industrial location violently, a slow but steady migration of industry to the Far West and the Southwest seems likely. While the overall pace of industrial wandering in the U. S. slowed down slightly in the past 5 yr, no slackening appeared in the three western states or in the Southwest.

Employment Patterns

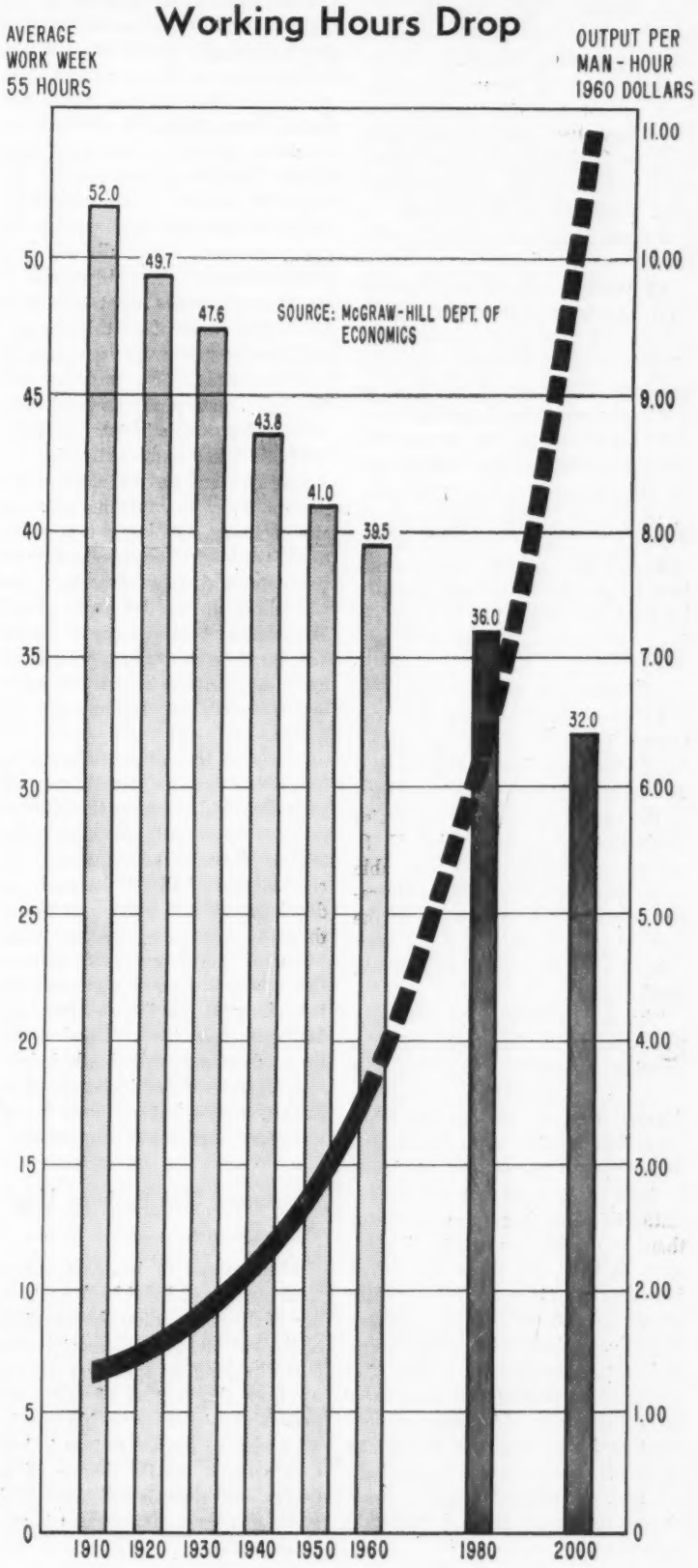
Three employment patterns stand out over the last half century. The first is the large relative growth of the service-oriented industries—transportation, public utilities, trade, finance and service—compared with factory employment. In 1910 roughly one worker in four was a factory employee, and the same proportion holds today. Meanwhile, all other industries have grown both in the absolute number of employees and as a relative proportion of all workers.

In part the trend toward greater consumption of services stems from our higher standard of living. Only a small proportion of families hire personal services in the form of servants or valets as they once did, but our consumption of other types of services runs high. Travel, for example, is essential for business and also popular for vacations. And with the growth of business have come increased financial services, both for business and for the individual consumer.

Also, our technological society has created a demand for new types of services. A universal characteristic of all of our wonderful new machines from computers to typewriters and from washing machines to electric can openers is that they sometimes get out of wack. Repairing most of our new gadgets is a job strictly for the professional repairman.

The second significant trend in employment is the absolute decline

Output per Man-Hour Rises . . . Working Hours Drop



in the number of farmers. Fifty years ago one out of every three workers was a farmer or farm employee. Today, less than one worker in ten is down on the farm. Despite a decline in the number of farmers, however, farm output has risen enormously. Farms have been mechanized, chemicals for fertilizers and insect killers have been improved, and probably most important of all, farmers are now much better educated than they once were.

Agricultural schools and agricultural experiment stations throughout the country have been a very potent force in helping farmers with their problems. There is no doubt that hybrid corns and other botanical wonders developed at the agricultural experiment stations have been of major importance in raising productivity on the land. More important even than the technique, however, is the educated farmer who understands how to use the latest techniques in his field. Farming today is a far cry from the one-horse farm of yesteryear.

Improvements in farm productivity have benefitted not only the farmer, but everyone in the nation. Ample food supplies in this country each year with fewer and fewer men on the farms have enabled us to raise production in nonfarm jobs. U. S. industry might not have been able to produce as many cars, refrigerators or tinker toys as we did in the past 50 yr if workers had not been able to shift from farm to nonfarm employment.

The third significant employment trend in the United States is the growing importance of professionals — engineers, scientists, economists, doctors, lawyers, etc.—in the labor force. The number of professionals—self-employed as well as employed by industry, government and private institutions—has been growing faster than any other occupational category. In 1910 only three men out of 100 were professionals. Today nearly 10 out of 100 are in that classification. Our economy is getting more and more scientific every day. The demand for professional manpower to meet the needs of industry, government and the consumer in an age of spectacular scientific, technological and educational advances continues to accelerate and this will prevail.

Research Impact

The tremendous impact of research and development in the past 20 yr.—through World War II, the Korean War and the peacetime economy since 1953—is one of the key factors contributing to our nation's economic growth. This year total R and D will come to about $15 billion with industry performing two-thirds of the total and paying for about one-third. Over-all, this is a tenfold increase since 1941 and as much as 50 times what it was in 1910. The result of all this research and development work over the past few decades has been to create new products, new processes and even new industries, such as, plastics, synthetic fibers and electronics.

Research and development on the present scale is something new for any economy. We know that industry is working on hundreds of new products and new processes that will show up in the years ahead. Meanwhile, basic research carried out by a combination of government and private industry is carrying us rapidly into the age of space travel.

Many of the advances in chemistry, electronics, metallurgy and fuels that will occur in the effort to conquer space will also find industrial applications subsequently. The combination of all this research and development work will surely change the way we now live and work. Many of the changes will come in the 1960s, but many more will follow along in the 1970s, 1980s and 1990s as expansion of R and D continues. Research will clearly help to smooth some of the jiggles out of the business curve, but obviously it can't guarantee a continuous upswing.

Flattening Out Business Ups And Downs

Fluctuations in business activity from good to bad and back again are one of the outstanding characteristics of the last 50 yr. Business right now is still picking up speed on the way up from the bottom of our fourth postwar business cycle. No one has been able to foresee swings in business with a precise degree of accuracy, and there is still some doubt about exactly what factors trigger a downturn.

About one thing, however, there is little doubt. Once a recession has begun we have a good idea of what should be done to hasten recovery. And although that seems like a rather meagre discovery, it is not. There are two reasons why a prolonged period of poor business activity is unlikely in the future. First, changes have taken place in the structure of the economy that help to fortify it against downturns and that help start business going again once it has faltered. Second, the federal government and the Federal Reserve System have more and better statistical tools and knowledge about the workings of the economy than they have ever had before.

Foremost among the structural changes has been the growth of automatic stabilizers of business activity. These are elements of the economy that require no action by any person to set them in motion when business begins to slip. When workers are laid off from their jobs, for example, they immediately begin drawing unemployment benefits, which partially compensate for the drop in an unemployed person's income. Unemployed workers do not need to wait for Congress to recognize their plight and pass a law entitling them to benefits. Payments of unemployment benefits are automatic and immediate.

Other stabilizers in the economy are corporate income taxes and personal income taxes. Government spending continues on an even keel whether business is boisterous or not, but when corporate profits or personal incomes fall, collections by the government decline immediately, thus producing a government deficit with its stimulating effects on the economy.

The other side of the coin is that government officials and legislators now receive regularly the key indicators of the economic health of the nation. These are timely enough to alert the planners to action when it is necessary. Furthermore, they are advised by a council of professional economists. Speed is of the essence in combating swings of business, and knowledge of the proper course of action now permits the government to expedite its actions. Business fluctuations, however, are not a thing of the past. Automatic stabilizers and improved knowledge merely insure that recessions will be reversed

promptly. Thus the economy stands little chance of ever again stagnating as it did in the 1930s.

A Look Ahead

As much as the United States has grown in the past 50 yr, and despite the level of prosperity we have now attained, the years ahead will bring further improvements and dramatic changes. Population will grow from 180 million people in 1960 to 382 million in 2000—a figure that almost suggests standing room only. Nevertheless, our nation will still be sparsely populated relative to European countries.

To feed that horde, farms will be more mechanized than at present, improved growing and cultivating techniques will be in use, and there will be fewer but larger farms. An improved highway network will make it easier for farmers to get their products to market while still fresh and tasty. At produce terminals more mechanized facilities than we have today will sort, weigh, bag and load produce for the retail markets. In sum, food will get to the family more quickly than now and packaged better. Improved freezing and canning procedures will do a better job of retaining the taste of foods sold that way.

The western and southwestern parts of the country will have a much larger relative share of the population in 2000 than now. For each decennial census the geographical center of population—representing the middle point in the spatial distribution of the U. S. population—has been computed by the government. The population center was near Baltimore when the first census was taken in 1790, and by 1910 it had shifted nearly a thousand miles across the country to Bloomington, Ind. The 1960 census showed the population center was in the middle of Illinois, near the town of Centralia. There is no telling exactly how far west the geographic center of population will swing during the coming four decades, but it is sure to move west, reflecting the westward movement of the population.

Employment will more than double in the next 40 yr, with more rapid gains for nonmanufacturing industries. Rising consumer demands for services will call forth especially large employment increases in that industry. Opportunities for mechanization and automation of the service industry are limited, so larger increases of workers will be required than in factories for a proportional increase in production. In other service-oriented industries, such as, finance, there are some opportunities for automation, as the introduction of mechanical check recording and tabulating equipment in banks illustrates.

Wages will continue to rise briskly over the coming decades. A high and rising level of capital investment will stimulate productivity increases and the work force will upgrade its skills considerably. One of our strongest national assets in the economic race with other nations is our educational system. Although it is not always obvious, the useful skills and knowledge people acquire are in a sense a form of capital. The quality of work produced by our present labor force is much higher than it was 50 yr ago, and a corresponding improvement will take place in coming years.

The role of education in upgrading the quality of the labor force has not yet been measured satisfactorily, but many economists believe that if it is ever measured education will prove to have been much-more important in raising productivity than is commonly believed at present.

Not only will workers be better paid in the decades ahead, they will have more leisure time in which to spend their higher incomes. The average work week, currently about 40 hr, will fall to 32 hr by 2000. If a rapid increase in wages and a reduction of the work week took place suddenly in the economy, profits would probably be squeezed completely out of existence. But spread out over a long period, higher wages for less time on the job are expected to be beneficial.

We know that many people today have much more income than they need for the necessities of life—food and shelter—even if they have become accustomed to a private home and steaks over a charcoal grill in the backyard as their basic minimum needs. If people continue to earn more and more income, they must spend it again if the economy is to keep growing. A shorter workweek with more time for spending will give people an opportunity for taking longer trips, or give them an excuse for building a vacation home at the lake since they can enjoy it more.

That does not mean, however, that labor costs will bulk larger in production costs in future years than at present. The efficiency of the productive process will grow substantially. For the total economy, $10.85 dollars for goods and services will be produced per man-hour in 2000 compared with $3.68 in 1960. It is this growth in total output of the things people want relative to effort and physical resources used in production—economic growth—that enables us to have a growing standard of living.

In 2000 A.D.

By 2000 economic activity in our nation will total well over $2.5 trillion, compared with slightly more than $500 billion in 1960. Thus our total economy is expected to register a more than fivefold increase during the next 40 yr as compared with a slightly more than fourfold gain over the past 50. Our rate of growth will be faster in the future than in the past. We anticipate a growth rate of a little more than 4% per year over the years ahead, compared with a little less than 3% per year between 1910 and 1960.

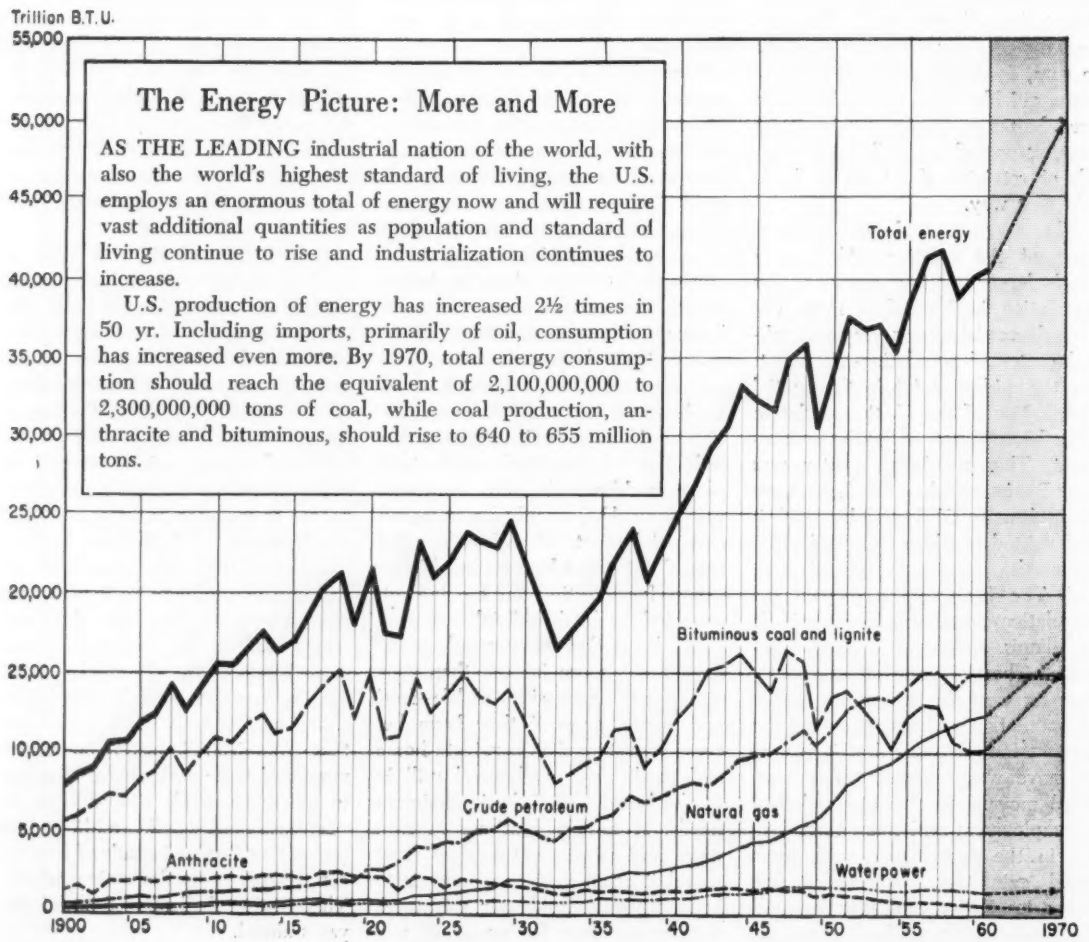
One factor which will play a much-more important role in determining our economic growth in the future than it has in the past is economic developments overseas. In the past our economy has been domestically oriented. Now and in the future the continued threat of the Russians to "bury" us economically as well as militarily means that we must strive harder to increase our research and development, to better our educational standards and to improve on our rate of productivity in order to grow faster. Furthermore, developments such as the European Common Market, the European Free Trade Association and the Latin American Common Market, indicate that American industry must get more and more competitive in order to sell more goods and services to overseas markets, in addition to preventing further inroads of foreign competitors in our domestic markets. This is the challenge of the forty years ahead.

A Half Century in Coal . . . And the Next 10 Years

FOR BITUMINOUS COAL the past half century has meant, among other things, a production plateau, even though it hit its all-time tonnage peak (631 million) in 1947. For anthracite it has meant a decline to less than one-fourth its output 50 years ago and one-fifth its 1917 peak of 100 million.

The era ahead is one of growth for bituminous; for anthracite, further decline. The rise, first, of oil competition and, second, natural gas, are the big reasons, with increased burning efficiency also a little-appreciated but potent tonnage-cutter—particularly for bituminous.

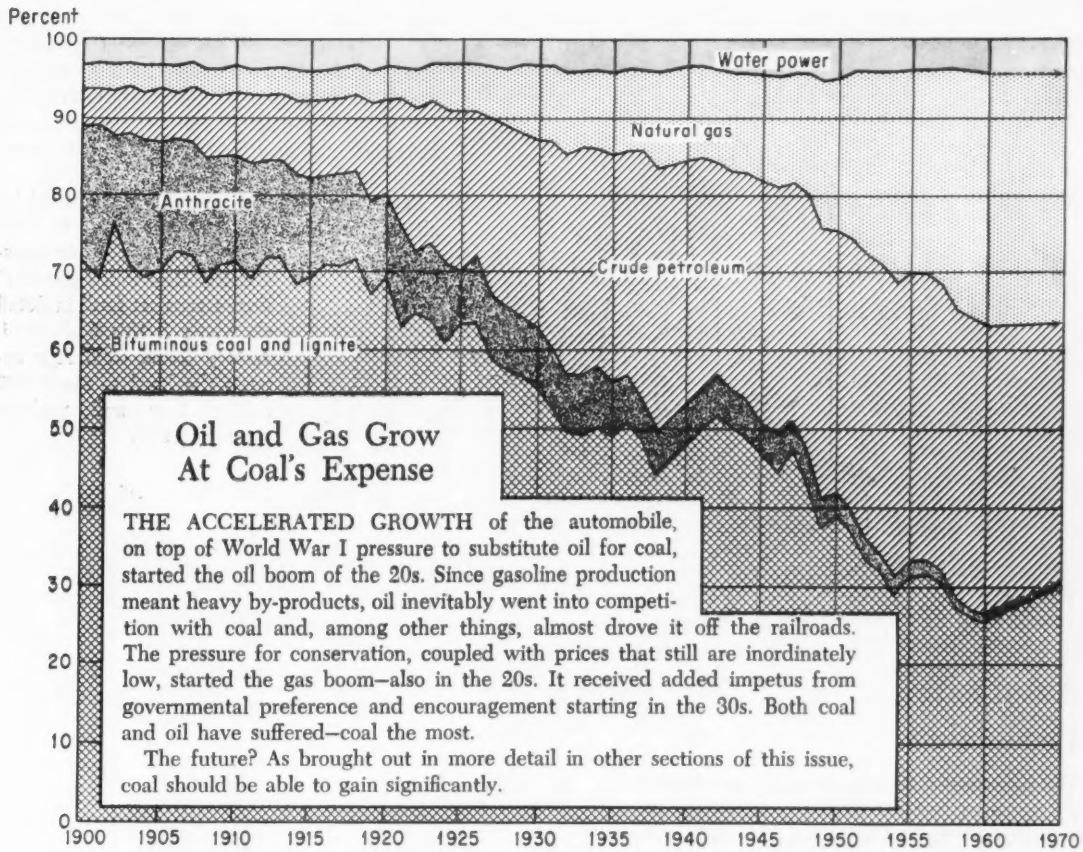
Transition under increasingly fierce competitive pressure from an era of steady growth into, for bituminous, one of only holding one's own or, in the case of anthracite, actual decline, can only result in major alterations in industry character and ways of doing business. Coal was no exception. Corporate structure, working force, investment policy, operating efficiency, marketing approach and overall management philosophy all reflect in one way or another the events of the past 50 years. What some of these effects were—and the outlook ahead—are summarized in chart and text in this highspot survey of a half century in coal . . . and the next 10 years.



The Energy Picture: More and More

AS THE LEADING industrial nation of the world, with also the world's highest standard of living, the U.S. employs an enormous total of energy now and will require vast additional quantities as population and standard of living continue to rise and industrialization continues to increase.

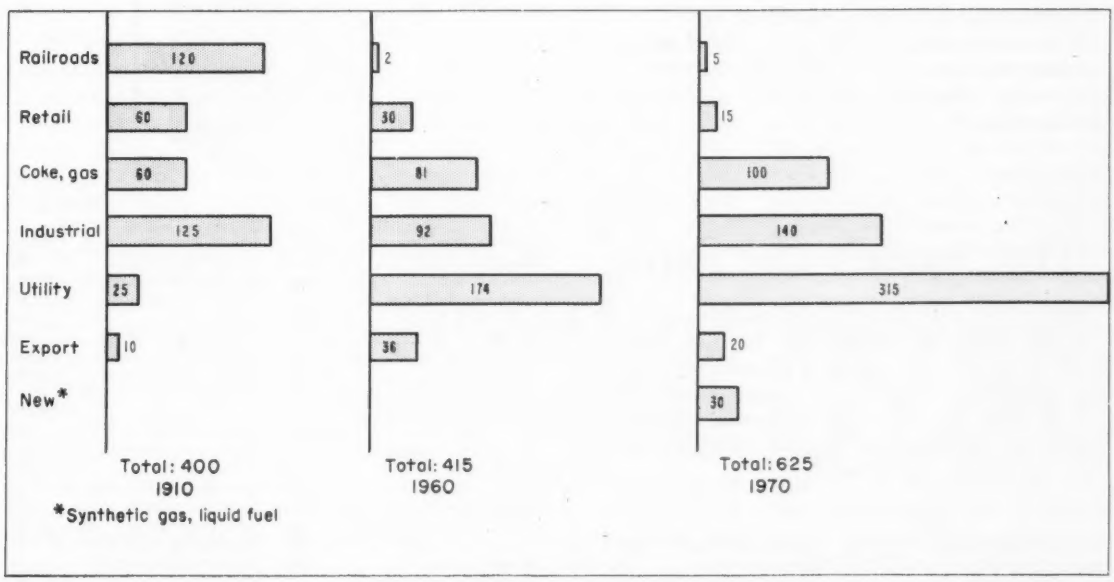
U.S. production of energy has increased 2½ times in 50 yr. Including imports, primarily of oil, consumption has increased even more. By 1970, total energy consumption should reach the equivalent of 2,100,000,000 to 2,300,000,000 tons of coal, while coal production, anthracite and bituminous, should rise to 640 to 655 million tons.



Oil and Gas Grow At Coal's Expense

THE ACCELERATED GROWTH of the automobile, on top of World War I pressure to substitute oil for coal, started the oil boom of the 20s. Since gasoline production meant heavy by-products, oil inevitably went into competition with coal and, among other things, almost drove it off the railroads. The pressure for conservation, coupled with prices that still are inordinately low, started the gas boom—also in the 20s. It received added impetus from governmental preference and encouragement starting in the 30s. Both coal and oil have suffered—coal the most.

The future? As brought out in more detail in other sections of this issue, coal should be able to gain significantly.



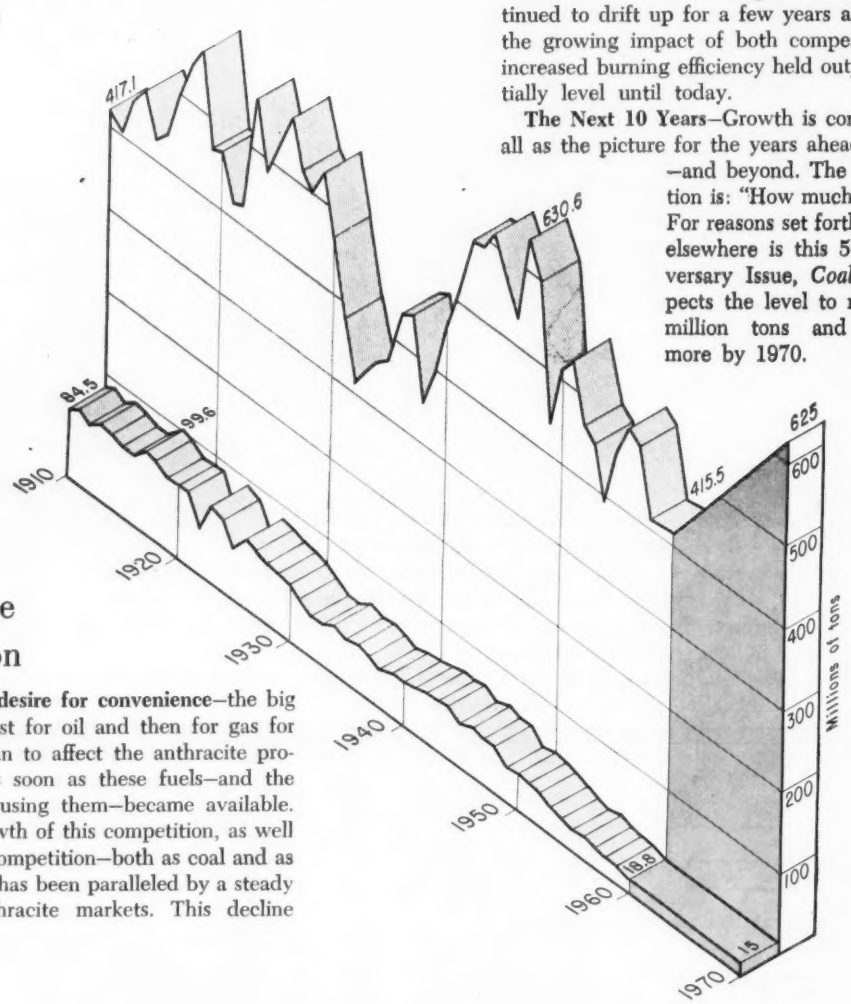
The Changing Market for Bituminous Coal

Big Loss—Railroad fuel market (132,049,000 tons in 1944); next biggest, retail deliveries.
Big Gain—Electric-utility fuel, also destined for the biggest growth of the future.
New Possibilities—Synthetic gas, liquid fuel, chemical char and carbon.

Bituminous Production

The Past 50 Years—Though bituminous continued to drift up for a few years after 1910, the growing impact of both competition and increased burning efficiency held output essentially level until today.

The Next 10 Years—Growth is conceded by all as the picture for the years ahead to 1970—and beyond. The big question is: "How much growth?" For reasons set forth in detail elsewhere is this 50th Anniversary Issue, *Coal Age* expects the level to reach 625 million tons and perhaps more by 1970.



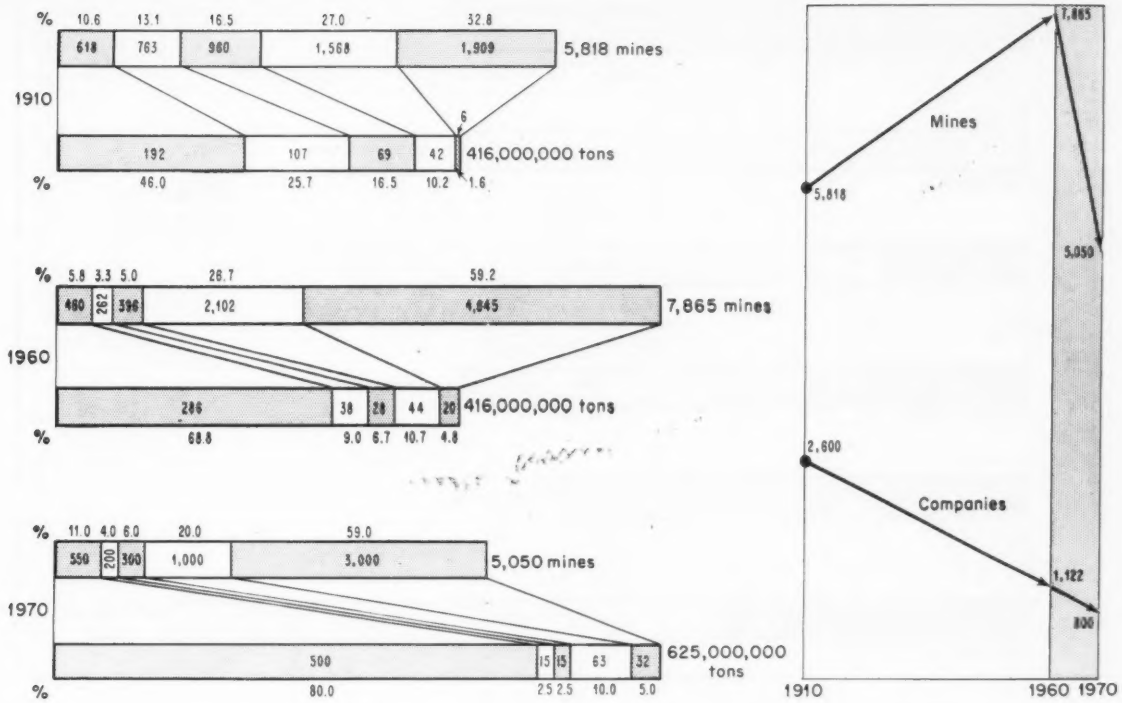
Anthracite Production

The American desire for convenience—the big selling point first for oil and then for gas for home use—began to affect the anthracite production rate as soon as these fuels—and the equipment for using them—became available. The steady growth of this competition, as well as bituminous competition—both as coal and as electric power—has been paralleled by a steady decline in anthracite markets. This decline will continue.

The Name's the Same

THE TIDES OF CHANGE have swept away hundreds of coal companies over the past 50 yr—and have left only a few of those that have survived with the same or approximately the same corporate names. The list of the latter and the original states of operation, obtained by comparing the *Keystone* directories of today and 50 yr ago, is as follows:

Allegheny River Mining Co.....Pa.
Barnes & Tucker Co.....Pa.
Beech Creek Coal Co.....Ky.
Berwind-White Coal Mining Co.....Pa.
Black Diamond Coal Mining Co.....Ala.
Borderland Collieries Co.....Ky.
Brazil Block Coal & Clay Co., Inc....Ind.
Brilliant Coal Co.....Ala.
Brookside Pratt Mining Co.....Ala.
Brushy Mountain Coal Mines.....Tenn.
Byesville Coal Co.....Ohio
Cannelton Coal Co.....W. Va.
Carbon Fuel Co.....W. Va.
Clearfield Bituminous Coal Corp.....Pa.
Clemens Coal Co.....Kan.
Clinchfield Coal Div. of the Pittston Co.....Va.
Colorado Fuel & Iron Corp.....Colo.
Connell Coal Co., J. G.....Anth.
Consolidation Coal Co.....W. Va.
Crozer Coal & Land Co. .....W. Va.
Crystal Block Coal & Coke Co.....W. Va.
Fentress Coal & Coke Co.....Tenn.
Gunn-Quealy Coal Co.....Wyo.
Independent Coal & Coke Co.....Utah.
Ingle Coal Corp.....Ind.
Jewell Ridge Coal Corp.....Va.
Juanita Coal & Coke Co.....Colo.
Kemmerer Coal Co.....Wyo.
Lehigh Valley Anthracite, Inc.....Anth.
Lorain Coal & Dock Co.....Ohio
Lumaghi Coal Co.....Ill.
Marmet Coal Co.....W. Va.
Masteller Coal Co.....W. Va.
Morrisdale Coal Mining Co., The.....Pa.
Mt. Olive & Staunton Coal Co.....Ill.
New River Co.....W. Va.
New River & Pocahontas Consolidated Coal Co.....W. Va.
North East Coal Co.....Ky.
Northwest Coal Co., Inc. .....Anth.
Norton Coal Corp.....Ky.
Page Coal & Coke Co.....W. Va.
Peabody Coal Co.....Ill.
Pennsylvania Coal & Coke Div. Fairbanks Whitney Corp.....Pa.
Piper & Co., Inc., W. H.....Pa.
Pittsburg & Midway Coal Mining Co.....Kans.
Preston County Coal & Coke Corp.....W. Va.
Republic Steel Corp.....Ala., Pa.
Rich Hill Coal Mining Corp.....Pa.
Rochester & Pittsburgh Coal Co.....Pa.
Roslyn-Cascade Coal Co.....Wash.
Roundup Mining Co.....Mont.
Saxman Coal & Coke Co.....Pa.
Slab Fork Coal Co.....W. Va.
Spruce River Coal Co., The.....W. Va.
Sterling Coal Co.....Pa.
Stineman Coal & Coke Co.....Pa.
Stonega Coke & Coal Co.....Va.
Susquehanna Collieries Co.....Anth.
Sycamore Coal Co., Princess Coals, Inc.....W. Va.
Tennessee Coal & Iron Div.....Ala.
Tennessee Consolidated Coal Co...Tenn.
Truax-Traer Coal Co.....Ill.
Union Pacific Coal Co., The.....Wyo.
United States Coal Co.....Ohio
Valley Camp Coal Co.....W. Va.
Valley Coal Co.....Pa.
Virginia Anthracite Coal Corp.....Va.
Virginia Iron Coal & Coke Co.....Va.
Virginia-Lee Co., Inc.....Va.
West Kentucky Coal Co.....Ky.
Westmoreland Coal Co.....W. Va.
Wind Rock Coal & Coke Co.....Tenn.
Wise County Coal Corp.....Va.
Woodward Iron Co.....Ala.
Woolridge Coal Co.....Pa.
Youghiogheney & Ohio Coal Co...W. Va.
Yuma Coal Co.....W. Va.
Zeigler Coal & Coke Co.....Ill.



Fewer Bituminous Companies, More Mines

BITUMINOUS COAL has been no exception to the rule that as an industry piles up the years the corporations in it tend to get fewer and larger. Thereby they can command greater sums of money for capital improvements, can achieve a greater degree of price stability, and can bring more and better talent to bear on marketing and all its supporting activities.

With approximately the same tonnage in both years, a check of *Coal Age's* affiliated *Keystone Coal Mine Directory* for 1910 shows some 2,600 companies meeting today's listing requirement of 100 tons per day capacity or more. In the 1960 directory the total was 1,122 for the U. S. The 1960 anthracite total was 66 companies, against 128 in 1910; Canada, 27 in 1960; 35 in 1910.

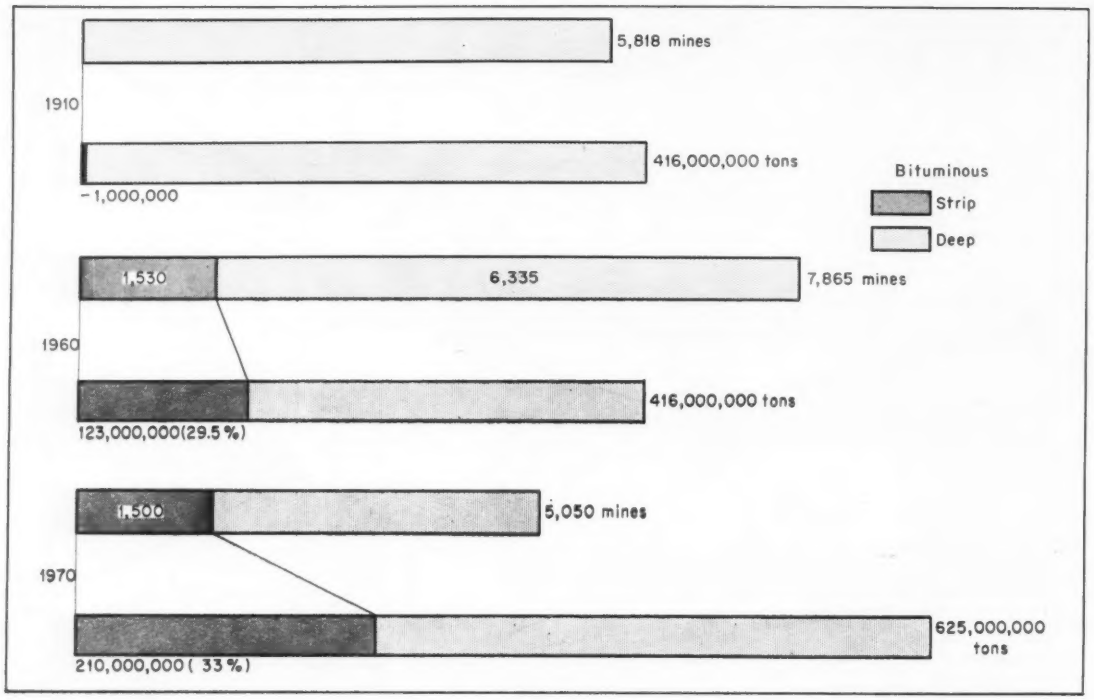
The picture in bituminous mines, however, is radically different. The number today is much higher than in 1910—almost entirely a result of the growth in number of operations producing 50,000 tons or less in the years since the late 20s. In 1910, these mines (3,477) accounted for 11.8% of the output. In 1960, the number was 6,747 and they accounted for 15.5% of the tonnage.

In contrast, the number of bituminous mines turning out 200,000 tons or more a year was 732 in 1960, compared to 618 in 1910. But against 46% of the output in that year, these mines now are responsible for 77.8% of the bituminous total.

The medium-sized mines, in short, have been taking it on the chin. The big mines make it by, among other things, capital investments and sales arrangements normally impracticable for the medium-sized property, which often is the owning company's only asset. And that company has much the same overhead and the same wage contract as the big operations, whereas the small-mine concerns have minimum overhead, frequently (though not always) a lower capital investment and, most important of all in many instances, an employee arrangement that results in much-greater performance for a lower wage bill.

The Next 10 Years—The picture is relatively clear as to the number of bituminous companies with a capacity sufficient for *Keystone* listing. The merger trend continues and the one-mine and other medium-sized organizations remain vulnerable. Consequently, it can be assumed that the number of *Keystone*-listed companies in the year 1970 will be not over 800.

The picture as to number of mines is less clear, except that there will be more of the super operations and fewer of the medium-sized. The small properties present the biggest guessing problem. There is nothing in the picture to indicate that anything can put them out of business aside from exhaustion of mining sites. But they will tend to get a little bigger because they too must invest more for efficiency and quality improvement in the future, while the recent downward trend in number should continue for at least a time. So the hunchplayer might put the total at 4,000 in 1970, accounting for 15% of the tonnage.



Stripping Grows With Bigger Equipment

STRIPPING as a method of mining is as old as the coal industry, since the primitive miner, working along the outcrop, could do little else but quarry his output, at first disposing of the spoil by hand and later employing wheelbarrows and carts. When the overburden became too heavy for hand removal, horses or other draft animals with plows and slip scrapers were adopted, as in the anthracite region before 1820, where careful search may still uncover traces of the old wheelbarrow runs.

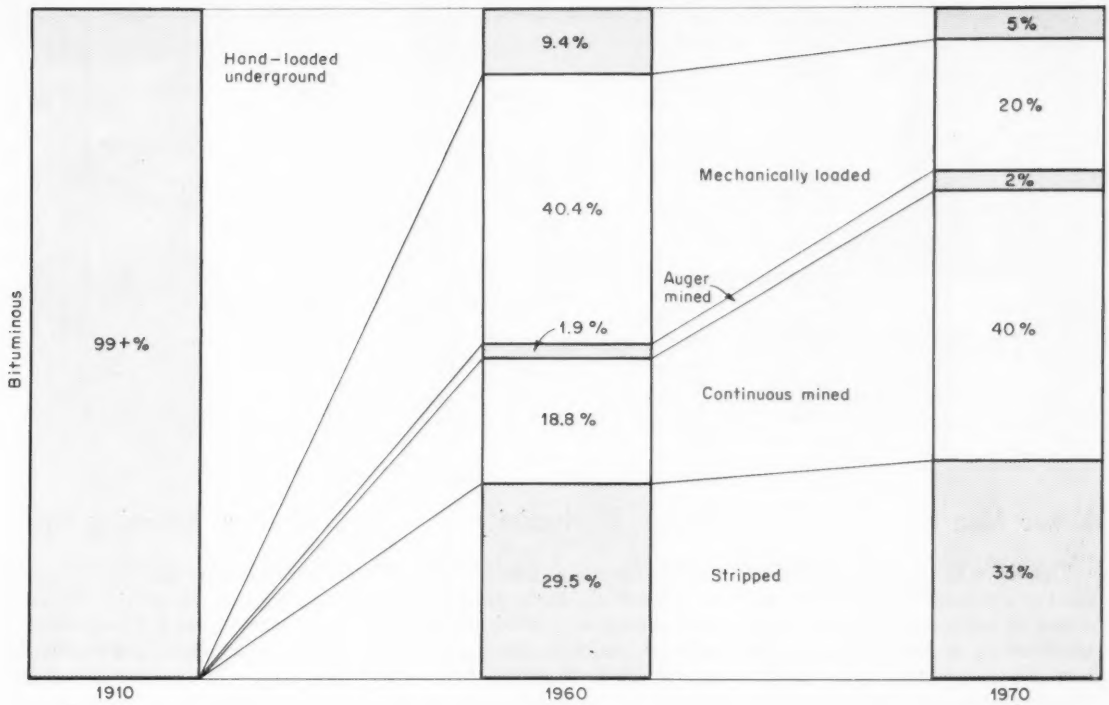
Mechanization of stripping in the U. S. is the outgrowth of the invention of the steam shovel by Otis, who was killed trying it out. The modern type of full-revolving shovel did not arrive until 1911, and even then did not solve all the problems of the stripping industry. However, this 3½-cu yd machine, installed at Danville, Ill., was the precursor of the 115-yd units now under construction—undoubtedly to be followed by other even larger excavators in future years.

Stripping grew and still is growing for the simple reason that within the overburden limitations of the machines the differential under deep mining—even of the highly mechanized type—still is 25¢ to $1 or more per ton. In the early days the lack of preparation made strip coal difficult to dispose of, which offset to a considerable degree the cost advantage. As soon as the industry turned to modern preparation, and particularly to washing, drying and so on, this handicap disappeared and stripping was then firmly on its way to a major role in coal mining.

Stripping growth has been steady since the first of the modern units in 1911. Data on strip operations were not compiled until 1914, in which year 35 "power strip pits," excluding horse operations and mines doing both stripping and deep mining, turned out 1,281,000 tons, or 0.3% of the total bituminous output. These 35 mines operated 48 power shovels and draglines. In 1960, 1,530 strip mines with some 3,500 shovels and draglines produced 122,630,000 tons, or 29.5% of the total of the bituminous industry. Stripping also accounted for 37.8% of the anthracite production in 1960.

The Next 10 Years—Deep-mining developments—or the lack of them—are the biggest unknown from the standpoint of stripping progress in the years immediately ahead. In contrast to stripping, air and roof support must be provided in deep mining, while working in darkness and confined places also take their toll in efficiency. For deep mining to overtakes stripping, machines and systems must be developed that will either eliminate these handicaps or offset them by major increases in face productivity.

The auger and the remotely controlled robot miner provide partial answers even now, and show what might be possible in the future. Tons per man for auger operations are substantially higher than for stripping, for example. Further developments may make these or other units able to work from underground and even-more competitive in tons per man. But time will be required. In 1970, therefore, it can be assumed that stripping percentage will be as much or more than at present. The reserves are available and equipment developments continue.



Machines Take Over Underground

WORK WITH PREDECESSORS of the present continuous-mining machines for deep mines goes back to 1888 when a Stanley header—a progenitor of the present-day boring-type miners — was imported from England and installed in the Franceville mine, near Colorado Springs, Colo. Coincidentally, Colorado also produced the Silver machine, which was the ancestor of today's ripper units, in 1948—also the year of introduction of the Colmol. Loading machines of today go back to 1893 when experimental work leading to the development of the Jones (Coloder) unit began. The self-loading conveyor was developed by Union Pacific Coal Co. in 1926, while the auger goes back to the Lilly and McCarthy machines of around 1945. The remotely controlled robot miner dates back to the Carbide unit of 1950.

But though the ideas came early, metallurgy and design lagged, and it was not until 1923 that data on mechanical production were first published. In that year, 1,880 tons was mechanically loaded or handled. Data on production by continuous miners first appeared in 1952, in which year they accounted for 8,215,000,000 tons of bituminous. In that year, also, augers turned out 1,506,000 tons—all bituminous.

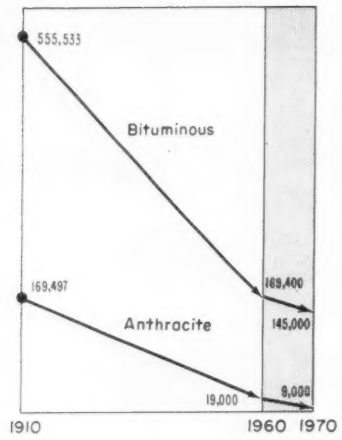
Thus, for all practical purposes coal production in 1910 was hand loading underground, though machines handled a few hundred tons and less than a million was produced by stripping. In fact, even 20 yr ago, in 1940, stripping and mechanical production underground still accounted for only 46% of the total—16% stripping and 30% mechanical underground.

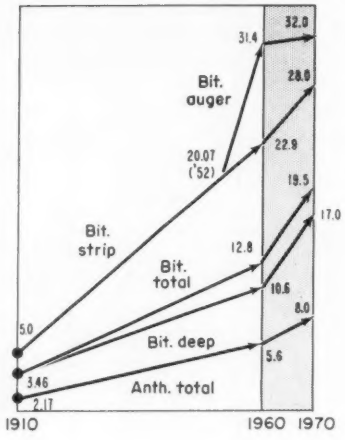
But rising wages and other costs put real pressure behind all forms of mechanical production, with the result that stripping is now 29.5% of the total bituminous tonnage; mechanical production underground 61% (conventional, 40.4; continuous and auger, 20.7; and hand loading, 9.4%. In short, mechanical production, deep and strip combined, has doubled in 20 yr.

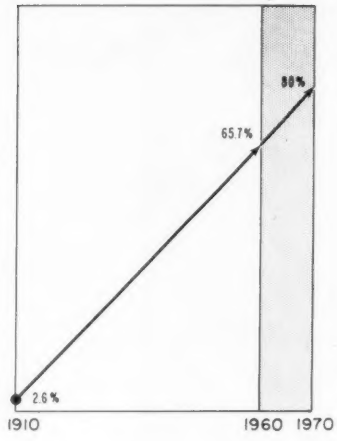
The Next 10 Years—As indicated in the previous material on the growth and outlook for strip mining, its percentage in 1970 should be about what it is today, though a breakthrough in underground equipment and technique might change this conclusion sharply. But whether the deep-mining percentage remains the same or grows, one thing is certain and perhaps two. The first is that there always will be, even in bituminous, a certain amount of hand production. It can be assumed that the minimum will be around 5%, even in 1970. The second is that the continuous miner eventually will take over three-fourths or more of the underground output—perhaps as early as 1970 and maybe even sooner.

Redesign of the remotely controlled robot miner for use underground will be completed in the next few years and 1970 will see them in use in considerable numbers, thus achieving almost the ultimate in laborless face production.

As indicated in a chart and discussion on the following page, the expansion of miner use and the development of new types will mean a major additional increase in tons per man underground.







Fewer Men

The drive to cut cost and thus meet competitive pressure has resulted in replacement of men with machines at an accelerating rate in bituminous, especially since the 30s when the United Mine Workers came back into power and Lewis began campaigning for wage increases. The same process also prevailed in anthracite, but the major reason for reduced employment in that industry is declining demand.

For bituminous for the future, it will be a race between higher output and higher tons per man, possibly culminating in a total employment of 145,000 in 1970. Anthracite employment in that year probably will not exceed 9,000 men. For bituminous, the total is based on a 625- to 650-million total output, 19.5 tpm and 220 days in 1970.

Higher Productivity

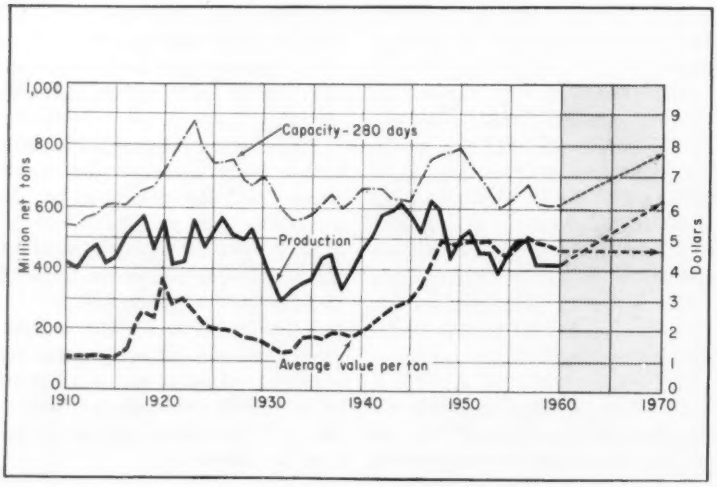
The accelerated pace of mechanical production—both stripping and underground — carried bituminous output per man per day up to 12.83 tons in 1960. The 1910 figure was 3.46 tons. The rise has not been as spectacular in anthracite because it is less susceptible to machine methods underground, though it has done well in stripping. As a result of its efforts, productivity per man attained 6.0 tons in 1960, compared to 2.17 tons in 1910.

Further investment and new developments in equipment size, coupled with increase in capacity and robot operation, mean a continued rise in tons per man to around 19.5 tons for bituminous and 8.0 for anthracite in 1970, reflecting rises in each type of mining—strip, deep and augering—in the next 10 yr.

Mechanical Cleaning Up

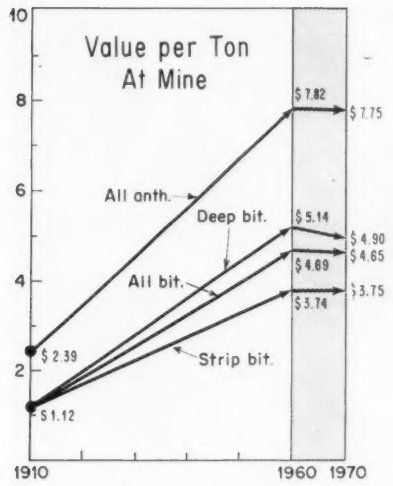
Higher quality has been a second major weapon, along with low cost, in the competitive battle—particularly for bituminous. As a result, the percentage of coal mechanically cleaned—primarily by washing—has risen from 2.6 in 1910 to 65.7% in 1960. Anthracite has been practically completely washed for many years. To accompany its washing, the bituminous industry has gone heavily into drying, and now processes over 15% of its washed output in thermal equipment, in addition to a substantial percentage dewatered in mechanical equipment.

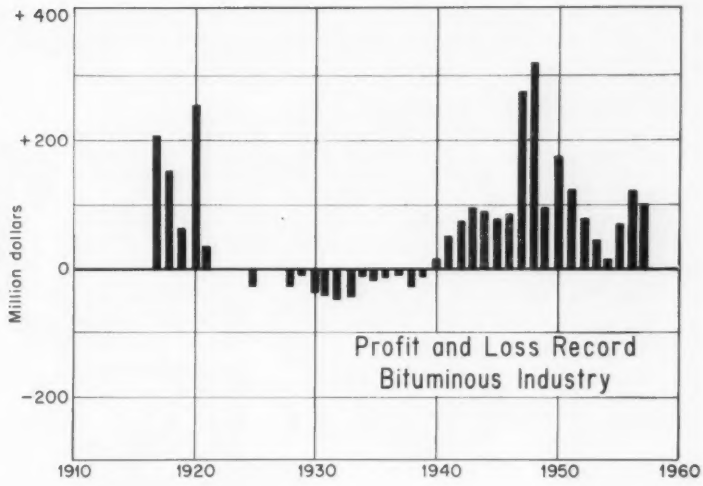
Though the raw-coal concept of mining and burning is now finding some practitioners, the mechanically cleaned percentage should continue to rise, possibly reaching 75% by 1970.



Bituminous Capacity Vs. Output and Value

Bituminous mine capacity continued to rise after World War I until forced liquidation brought on a red-ink period (see chart next page) lasting until World War II, when bituminous again became profitable as an industry. There was a high degree of correlation between excess capacity in the period between the wars. Then value began to strengthen relative to capacity increases, reaching its peak in 1948. It has since remained relatively stable in spite of subsequent capacity liquidation.



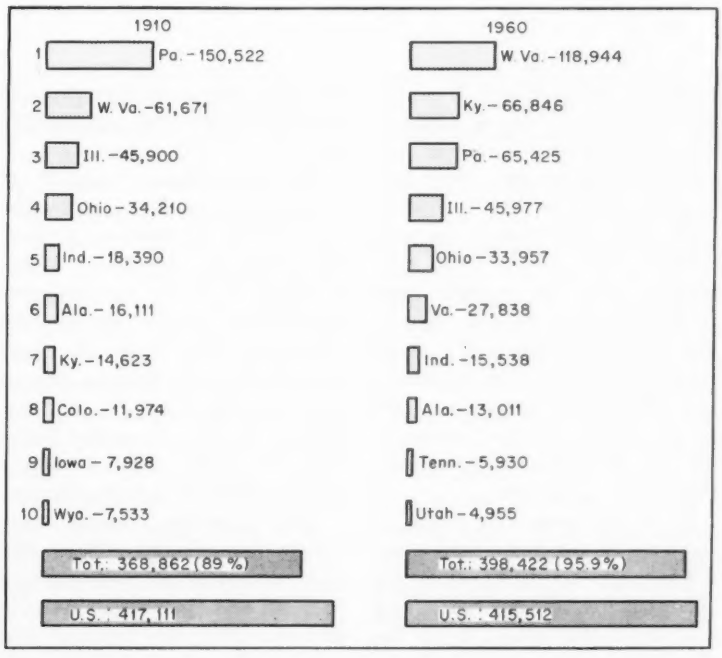


Value Stabilizes, Profit Opportunities Improve

EXCEPT FOR DEPRESSION PERIODS, steadily rising wages and other expenses meant steadily rising prices for bituminous until 1948, when the gains from increased machine use began to offset the rises in costs. Now bituminous actually is valued at the mine at less than the figure 13 yr ago. Since tons per man will rise some 50% more, the average value in 1970 should not be too different from today. The same pattern should prevail in anthracite.

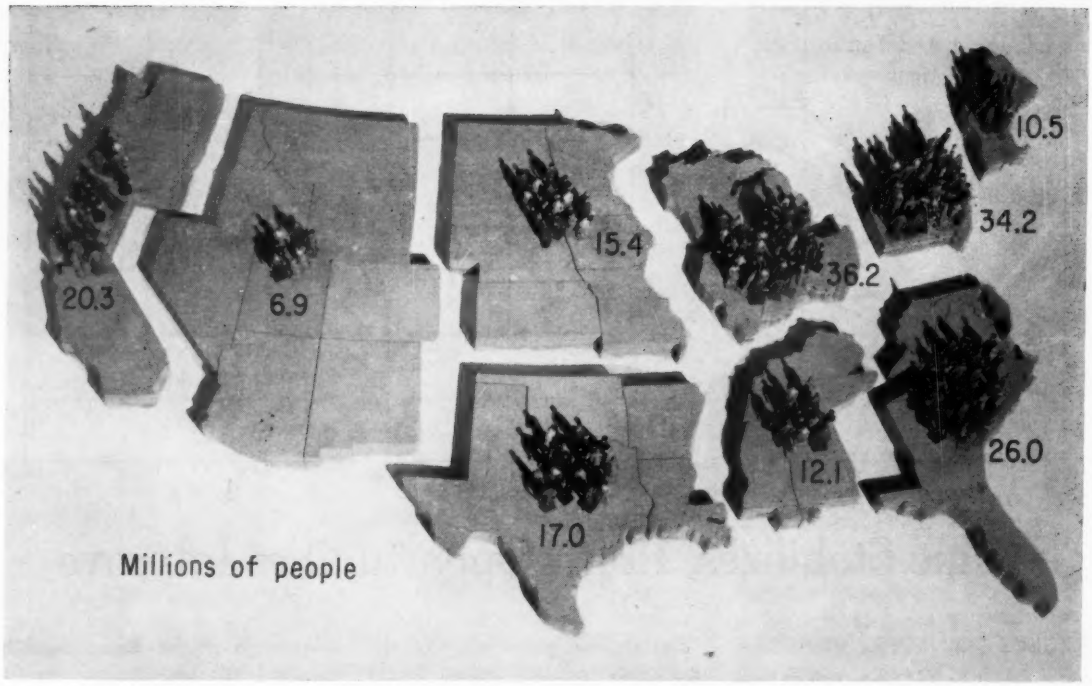
The general profitability of the bituminous industry before World War I is confirmed by Treasury Dept. data. After the war, the stoppage of growth and the rise of competition resulted in the disappearance of profits for the industry as a whole until World War II. Then there was another slump until the investments in cost-cutting equipment began to pay off. Then another depression set in.

The general conclusion must be, however, that the larger, soundly managed organizations—and even the smaller in the same category—will continue to find good profit opportunities. In 1960, bituminous companies accounting for sales of 85,000,000 tons—almost all mined by themselves—averaged 47½¢ per net ton profit after all taxes and charges. This is a rate of conversion of gross sales income into net few corporations in any line of business are able to match.

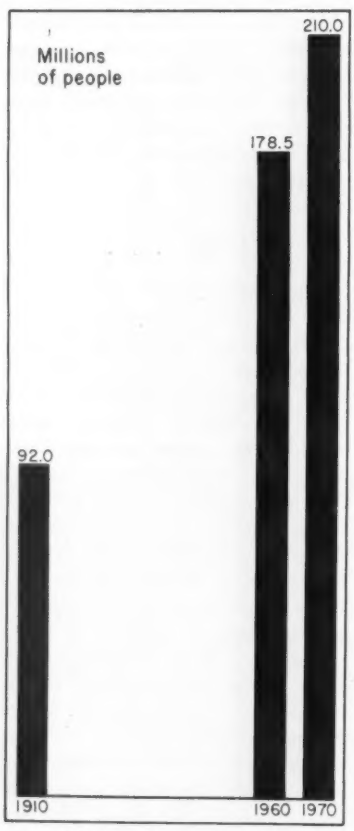


The Big Ten . . . Then and Now

Seven of the states in the first ten among bituminous producers in 1910 were still in the list in 1960—some in radically different spots. West Virginia moved into first place, dropping Pennsylvania to second, from which it was ousted by Kentucky. Colorado, Iowa and Wyoming dropped out, reflecting the heavier pressure of competition in the Far West. Virginia moved into the list and now holds sixth place. Tennessee, another newcomer, is in ninth place. These two accessions reflect the heavier concentration of output in the East and South. Only one western state is now in the first ten—Utah, one of the major sources of coking coal in the West. The Big Ten now account for 96% of the output, against 89% in 1910.



THE EAST HAS THE PEOPLE—Though down some over the years, most of the people in the U. S. live, work and buy east of the Mississippi. Heaviest concentration is around the Great Lakes.



UP TO 210,000,000 or more is the 1970 population prospect.

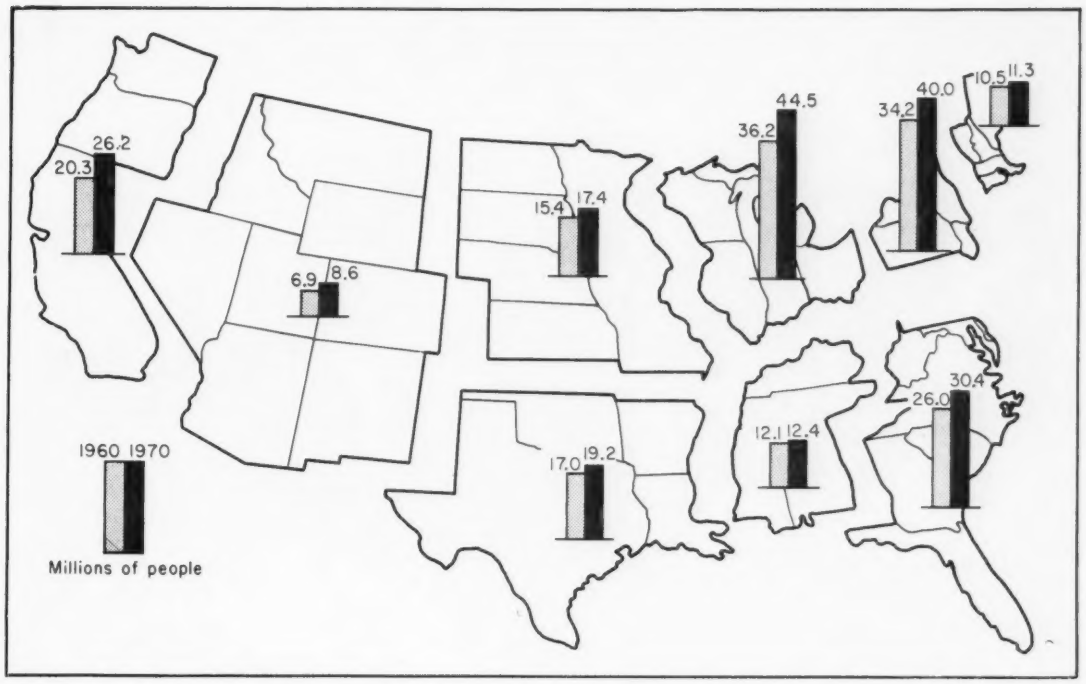
People . . .

WHERE PEOPLE are is where business is done, because ultimately only people are consumers and business tends to settle down next to people to serve both established needs and create desires for new products. This is not 100% true, because mines, for example, must be where the minerals are found, and some businesses find it more economical overall to go where the raw materials are rather than build in the center of the consuming territory. Normally, however, business cosies up to people.

U. S. population (48 states) at the time of the 1960 census was 178,464,000, up 18.4% from the 1950 tally of 150,697,000. Going back to the 1910 census, a year before *Coal Age* came into existence, total U. S. population was 91,972,000.

The 1910 census showed 70.3% of the population living and working east of the Mississippi River. For 1950, the figure was 69.2%, dropping to 66.7% for the 1960 enumeration. Thus, though the Southwest and California have marked up major gains in population over the years, the big majority of people tend to stick to the East and South where the heavy concentrations of industry also are.

The population, barring some catastrophic calamity, such as, full-scale nuclear attack, will continue to grow at an increasing rate. By the year 2000, the mainland total



INCREASE IN THE WEST—In the next 10 yr the territory west of the Mississippi will continue to gain in population, reaching 34% of the mainland total in 1970, compared to 33.3% in 1960.

How Many and Where . . .

Now and in the Future

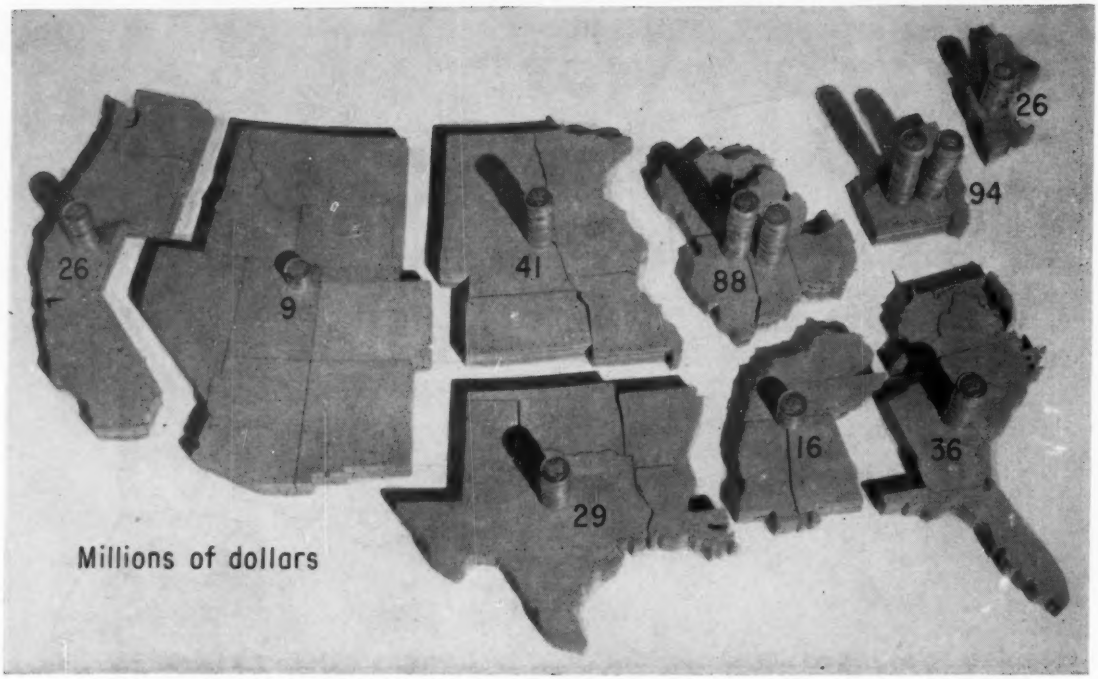
could reach and exceed 380 million, with the absolute minimum almost certainly 350 million. This compares, it will be remembered, with 178,464,000 in 1960. In fact, the estimated additions to the population in the first 6 mo of 1961 was 1½ million. As these additions grow up and in turn also bear children, and as the life span continues to increase, rates such as this mean a major buildup in the years ahead.

A mainland population of 380 million, incidentally, would mean a density of 126 people per square mile, compared to 60 for 1960. This does not necessarily mean crowding overall, though by 2000 it is likely that the East Coast from Boston to Norfolk — and perhaps from Maine to Florida — will be almost solid city. But overall, the prospective density is much less than the present figure of 300 or more people per square mile in western Europe, and the present peak for that area of over 800 per square mile for The Netherlands. So even though all U. S. land is not usable to the same extent as in The Netherlands, there should be room for 350 million people—and many more—in the year 2000.

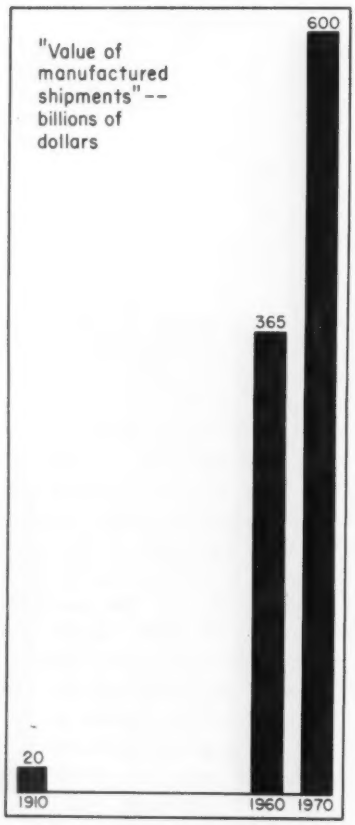
In a less-distant year — 1970 — the estimates of total population range from 208 to 220 million, depending upon which birth, death and immigration rates are employed in forecasting—and of course on the assumption that there will be no interference by war or depression.

Shifts in population will of course continue and by 1970 the percentage of population west of the Mississippi will have increased still further to around 34.0. In part this will be a result of movement of retired people to certain sections, but more the result of the process whereby certain industries move to the source of raw materials, bringing with them people and other industries to serve them.

East of the Mississippi the East North Central is expected to continue to gain percentagewise as well as in total population, while New England's percentage will drop again and other sections will fare variously.



THE EAST HAS THE INDUSTRY—Despite gains west of the Mississippi, the East still accounts for 71.2% of the total "value of manufactured shipments" in the U. S. Population concentration is one answer.



MAJOR GROWTH is the industry outlook to 1970.

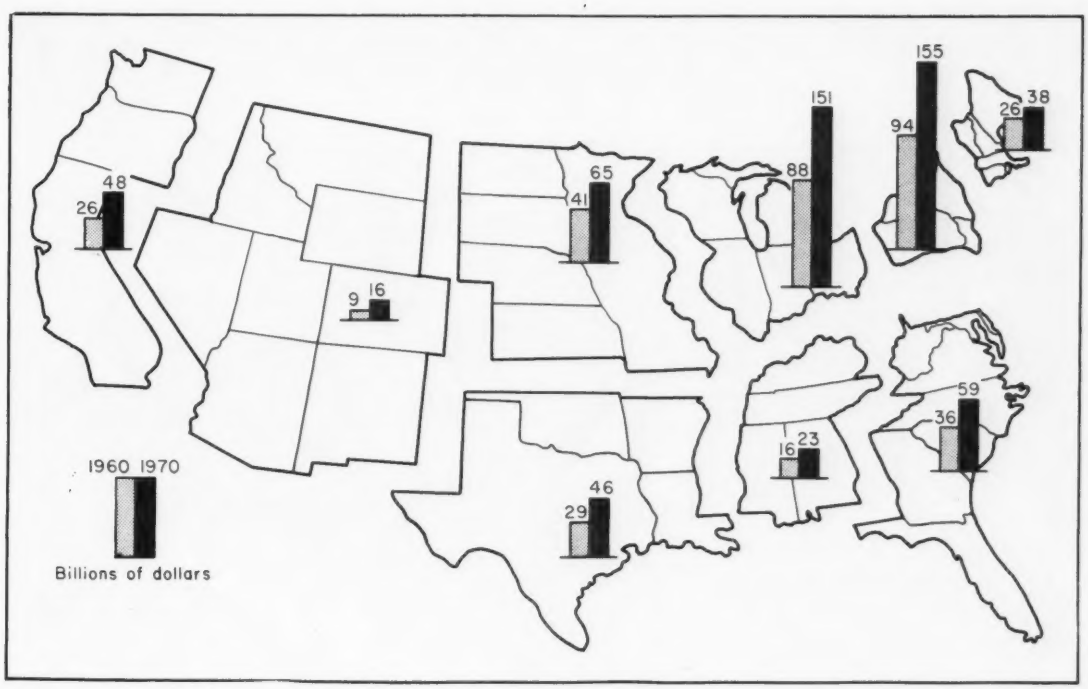
Industry...

ONE BASIS of rating industry in size and growth rate is total "value of manufactured shipments." On this basis, U.S. industry racked up $365 billion in 1960. Of this total, establishments east of the Mississippi River accounted for approximately $260 billion, or 71.2% of the total. The corresponding population percentage was 66.7. Establishments west of the Mississippi accounted for $105 billion in 1960, or 28.8% of the total. The population percentage was 33.3.

Value of shipments 50 yr ago, in 1910, was around $20 billion. The 1910 dollar, however, was equivalent to three 1960 dollars, which would make the 1960 equivalent value approximately $60 billion and the 50-yr increase approximately six times.

This six-time increase is compounded of a doubling of population and a tripling of shipments per unit of population. In 1910, in terms of 1960 dollars, the per capita value of manufactured shipments was around $650 a year. In 1960 the figure had risen to $2,050 per person per year.

Increased productivity per worker as a result primarily of capital investment, and many new products, such as, automobiles, television and air conditioners, to name but a few, are major reasons for this growth, with productivity rises undergirding the wage increases making it possible for people to buy these.



WEST OF THE MISSISSIPPI continued growth in population and manufacturing capacity will increase that area's percentage of "value of manufactured shipments" to 29.1% in 1970, compared to 28.8% in 1960.

The Concentration Picture . . .

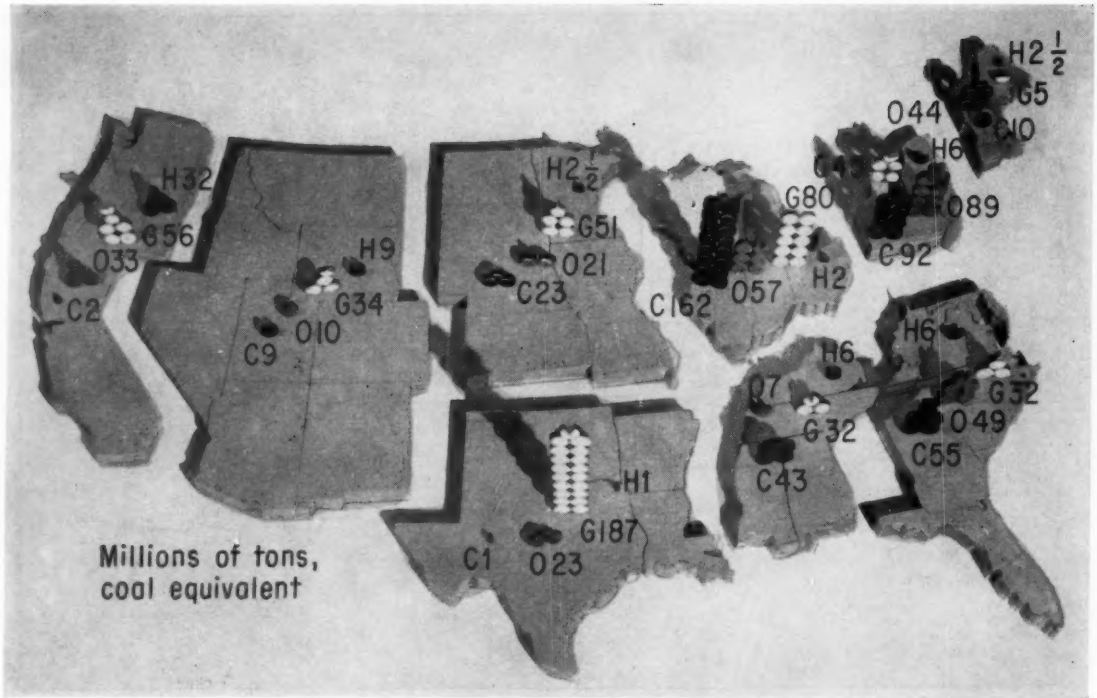
Now and in the Years Ahead

The process seems to be accelerating, which is another way of saying that the standard of living continues to rise for the U. S. citizen. In 1950, with a total value of shipments of $230 billion ($180 billion east of the Mississippi; $50 billion west), shipments per person per year were approximately $1,500. As previously noted, the 1960 figure was $2,050.

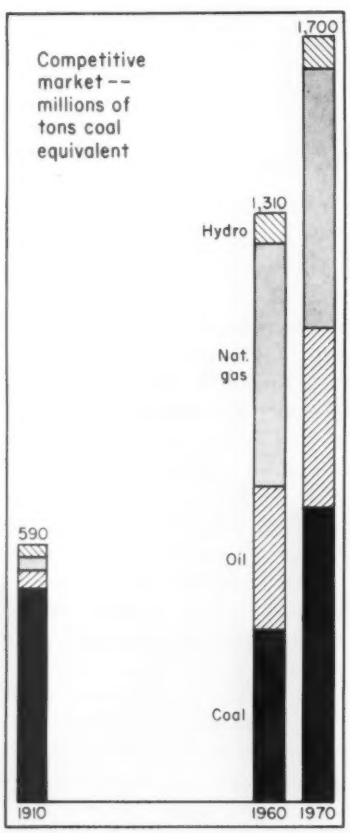
The standard of living will continue to rise in the U. S. In fact it must because history shows that with rare exceptions the only alternative is a backward slide. And the U. S. has or has reasonably ready access to the necessary resources, including plentiful low-cost fuel, with which to keep on the upgrade.

Since there is no bar—resources or otherwise—to further rises in the living standard, it can be concluded that value of manufactured shipments per person will rise to $2,750 or more by 1970. The total for industry then would be around $600 billion. The West's share should increase to around 29.1% or $175 billion, while industry east of the Mississippi should account for $425 billion, or 70.9%.

Thus, though the bulk of the business still will be done in the East, with the southern section becoming more important, the West will bulk larger and larger in the scheme of things. And as its industry grows so will its fuel and energy requirements. Though oil and gas will have the inside track in certain areas for certain applications, it is by no means a certainty that they cannot be challenged—even in Texas where a coal-burning utility already in existence is evidence of that fact. Hydro is a formidable foe in the Northwest, but here also things will improve as time goes on and the more-economic sites are developed. In the southern tier of Pacific and Rocky Mountain states the construction of two new coal-burning utilities in Arizona is evidence that the growing demand for energy in the Far West and the growing cost and unavailability of oil, gas and hydro will make coal increasingly attractive in that part of the Nation.



THE EAST USES THE FUELS—Consumption of the competitive fuels east of the Mississippi was 62.3% of the total in 1960, compared to population and industry concentration of 66.7 and 71.2%, respectively.



ENERGY IN 1970—over 1,700,000,000 tons total coal equivalent.

Fuel Use . . .

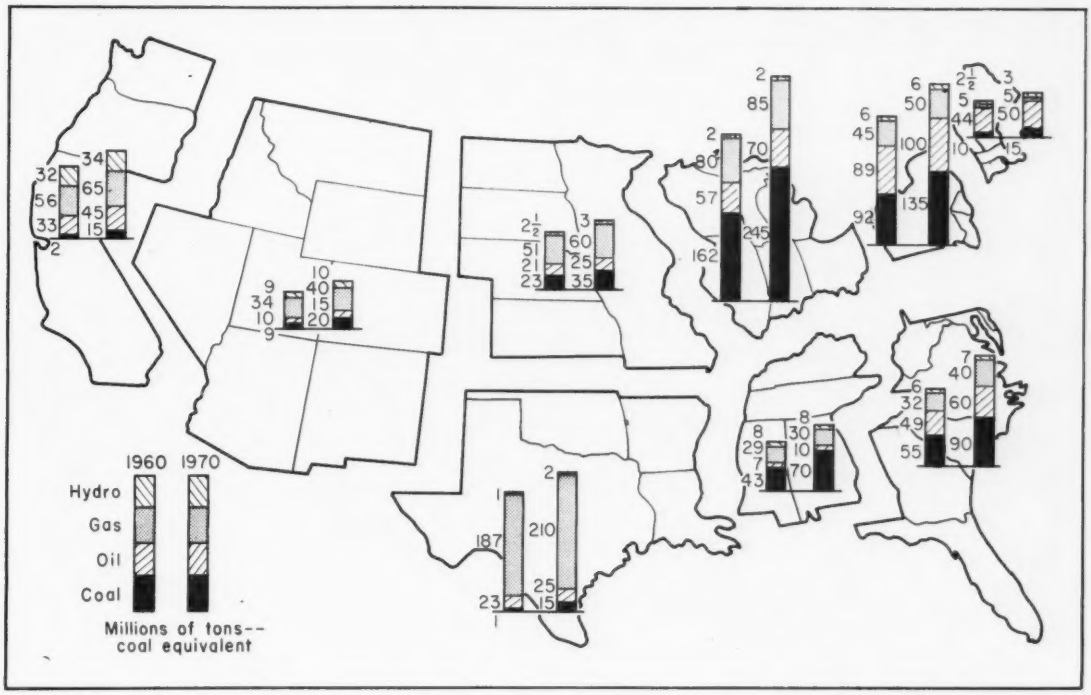
THE UNITED STATES consumed in 1960 energy equivalent to around 1,800,000,000 tons of coal. Excluding gasoline, jet fuel and certain other petroleum products, the consumption was approximately 1,310,000,000 tons. Except for diesel fuel for trucks, natural gas as a chemical raw material and the like, this 1,310,000,000 tons is the competitive-fuel market. The quantities in 1960 were:

Gas now is in first place by a considerable margin, having kicked oil out after it had reigned only a few years. Manufactured gas, incidentally, is not shown as such since it is represented by the oil or coal used in its manufacture.

	Million Tons Equivalent	%
Bituminous	376	28.4
Anthracite	17	1.3
LP gas	17	1.3
Kerosene	21	1.6
Distillates, including diesel	157	12.0
Residual and heavy fuel oil	137	10.5
Natural gas	517	39.6
Hydro	69	5.3

Grouping gives the following picture for 1960:

	Million Tons Equivalent	%
Coal	393	29.7
Liquid fuels	332	25.4
Natural gas	517	39.6
Hydro	69	5.3



WEST OF THE MISSISSIPPI consumption of the competitive fuels will rise at a lower rate than east of the river, with the West's percentage of the total dropping from 37.7 in 1960 to 36.4% in 1970.

The Competitive Picture . . .

Now and in the Years Ahead

Looking at the 1960 picture by areas shows coal with almost no business in the West South Central and Pacific states. Consumption in 1960 was modest in the New England and Mountain states. The big coal area is the steel and industrial East North Central section, followed by the Mid-Atlantic, South Atlantic, East South Central and West North Central sections.

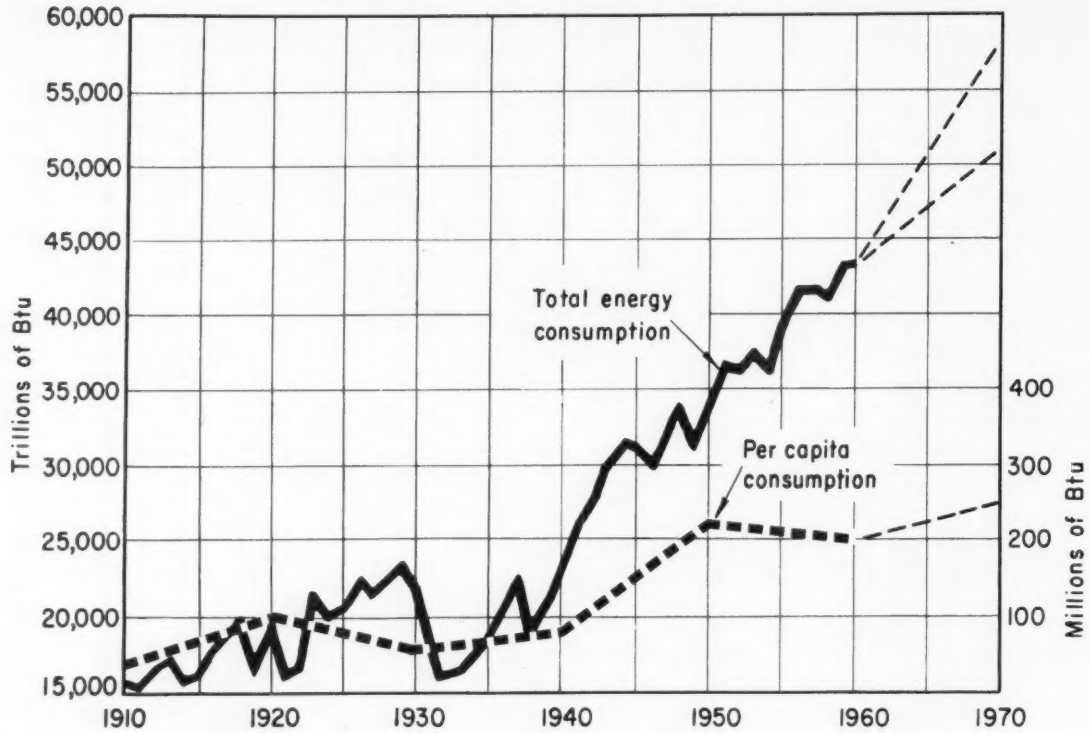
The leading liquid-fuel user is the Mid-Atlantic section, one reason being this area's big use of residual—almost double that of any other sections. This area also leads in the consumption of distillates, with East North Central right behind.

Natural gas is king in the West South Central states—Texas in particular where it has plowed oil deep under even though Texas is the source of the majority of U. S. crude production. This points up in still another way the leverage that natural gas has because its prices still reflect its original by-product status. This also has been a big reason for the spread of natural gas on a major scale into every area of the country except New England.

Hydro is predominately a Pacific Coast source of energy, with modest amounts consumed in the Mountain area and the southeastern states, plus certain sections of New England.

Consumption of all the fuels will increase as demand for energy continues to rise in the U. S. But there will be shifts and thus the competitive picture in 1970 might be as indicated on the accompanying section maps. For the reasoning leading to these conclusions, see the analysis starting on the following page.

The future is one of continued increase in the demand for energy. Consequently, the demand for all fuels will continue to rise. But there will be shifts and as a result the competitive picture in 1970 might be as indicated on the accompanying section maps, with coal gaining relative to other fuels. For the reasoning leading to this conclusion, see the analysis starting on the following page.



ENERGY CONSUMPTION in the U. S. could reach 58,000 trillion Btu in 1970, equivalent to 2,300,000,000 tons of coal, if the trend in per capita consumption continues up. The minimum in 1970, obtained by merely projecting the consumption curve, is 52,500 trillion Btu, equivalent to 2,100,000,000 tons.

The Competitive Challenge

Major growth can be the picture for coal in the next decade and beyond, but it will require taking a growing percentage of the market away from competition.

ANALYSIS of the competitive situation and its probable course in the years ahead logically starts with a look at total energy use now and in the future. The U.S. in 1960 used 44,864 trillion Btu, equivalent to 1,800,000,000 tons of bituminous coal. Per capita use in 1960 was 10.3 tons equivalent. Assuming the same use per person in the year 2000, consumption with 350 million people, which could easily be the number in the U. S., would reach the equivalent of 3,600,000,000 tons, or double today's total.

To get a little closer to the present, total energy use in the U.S. should reach a minimum of 52,500 quadrillion Btu in 1970. This is merely projecting the consumption curve as shown on the accompanying chart, which automatically compensates—in part at least — for average or normal increases in efficiency. Projecting on the basis of one estimate of total population in 1970, and using today's per capita consumption, the total becomes 53,000 trillion, or close to 2,100,000,000 tons equivalent.

Per capita consumption has risen for the past 50 yr, however, as the trend line on the accompanying chart shows. The figures automatically reflect the increases in efficiency achieved up to the time. Projecting the trend, per capita consumption could reach 275,000,000 Btu in 1970, which, with an assumed population of 210 million, would result in a total energy consumption of 58,000 trillion Btu, equivalent to 2,300,000,000 tons of bituminous.

The Competitive Market In the Year 1970

The possible total energy market in 1970, as noted, lies somewhere between 53,000 and 58,000 trillion Btu, or the equivalent of 2,100,000,000 and 2,300,000,000 tons. Perhaps as good an approach as any is to split the difference and work on the basis of 55,500 trillion Btu, or 2,200,000,000 tons equivalent, in 1970.

Elimination of the gasoline-jet

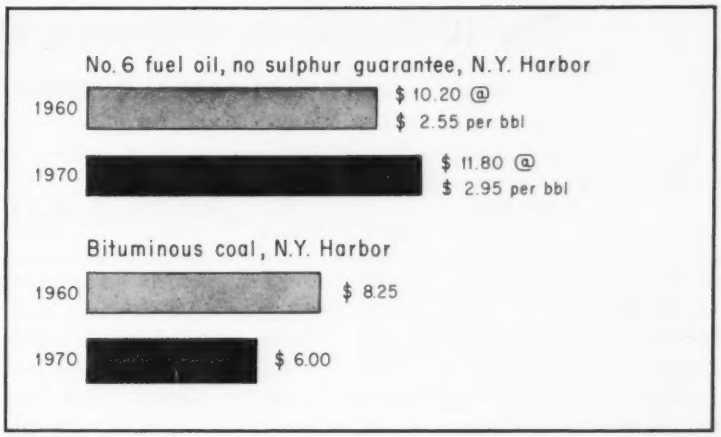
fuel-specialty fraction provides the approximate competitive total. It now appears that per capita non-competitive usage is not likely to be any greater in 1970 than today. Gasoline use per person has reached a plateau and may even drop in the future because of the lessened interest in driving and the increasing difficulty in the growing urban areas. One evidence is the fact that the petroleum industry is now embarking on an advertising and promotion campaign to try to induce people to do more pleasure driving and thus bolster faltering gasoline sales. It is not likely to be successful.

In line with this reasoning, the consumption of gasoline and specialty products could total the equivalent of around 500,000,000 tons of coal in 1970. Subtracting leaves a calculated "competitive" market of 1,700,000,000 tons in 1970. If bituminous coal's percentage in 1970 was the same 28.4 of 1960, its U.S. market would be 480 million tons. Production would be this total plus exports.

Since the electric utilities, according to the latest survey by *Keystone Coal Buyers Manual*, a *Coal Age* affiliate, plan to burn 63 million tons more themselves in 1965, and will continue to increase their usage after that, the previous conclusions seemingly become ridiculous. But this is not necessarily so. Gains in the utility section could be more than offset by losses elsewhere, though there is no need for assuming that this actually will happen. In fact, the opposite is more realistic.

The year 1965 could be the crucial year. The utility demand will rise to that time and even after. In other markets, new plants and processes that might put coal in more jeopardy than now could not be put in operation in significant numbers before then. So bituminous could have reasonable expectations of reaching a total output of 500 to 525 million tons around 1965, including exports to North and South America and overseas.

But if, say, the goal is 600 million or better around 1970, coal will have to either develop new uses, or take business away from oil and gas. In other words, it must reverse the trend and begin increasing its percentage of the competitive market.



OIL VS. COAL PRICEWISE—An indication of the possible price situation in competition for the heavy-fuel market in the New York Harbor area in 1970 is provided by this chart, based on trends in prices for No. 6 oil and expected developments in coal-freight and mine prices.

That is the challenge of the coming growth era.

What the outlook is and what is involved are analyzed in the following.

The Price Factor

Though there are other considerations which can and do outweigh it at times, the cost of fuel to the user is the big and often final factor in sales in the heavy power and industrial markets. On this score, the trend is more and more in coal's favor. The present labor content of the average ton of coal is 40 to 45%. At many mines (deep in addition to strip), the percentage is down to 20 to 25 with equipment and methods now available. This margin gives room for additional wage increases and rises in other costs with no necessity for raising prices. And the end is not yet in equipment and methods development. It can be flatly stated, therefore, that prices (in terms of today's dollar) will be no higher in 1970 than they are today. In fact, they might well be lower.

The delivered price is the thing that sways the customer, however, which brings in the subject of transportation charges. What the forms of transportation will be in 1970 can be debated at some length. Probably pipelines, special bulk-cargo trains and water will all be much in the picture. To make another flat statement, however, the rate for bulk handling will not be over 5 mills per ton-mile in 1970, again in terms of today's dollar.

This means, among other things, that a power plant in Houston, Texas, could be served with coal from southern Illinois, via pipeline, at as low as $6 per ton—$3 for the coal and $3 for transportation. That is a long way from being competitive with gas at this time, but in 1970 the situation might be quite different.

Most of the present competitive area could be reached, on the basis of 5 mills per ton-mile, at transportation costs of $1.50 to $2.50 per ton, with coal at the mine at $4 to $4.50. In other words areas as far from the coal fields as Boston would be served with coal at as low as $7 by 1970 and perhaps several years earlier. The big majority of the territory, including the critical Atlantic Coast, could be served at $5.50 to $6 per ton (mine price and overland transportation, but not including stockpiling, pulverizing, ash-handling and other charges involved in coal use).

These forecasts are based on handling coal in big cargoes or by some such continuous method as pipelining. The same freight charges could not be expected by smaller industrial and commercial establishments, though they could be offered the same mine prices. However, the

The 10-Year Price Picture in Natural Gas In Selected States

	Residential				Industrial Fuel			
	$ per MCF 1949	1959	% Rise	1959 Per-Ton Equiv.	$ per MCF 1949	1959	% Rise	1959 Per-Ton Equiv.
Alabama	$0.824	$1.017	23	$24.55	$0.171	$0.291	70	$ 7.00
Connecticut	.....	2.100	..	50.75	.....	0.906	..	21.85
Florida	0.860	1.387	61	33.50	0.131	0.295	125	7.10
Illinois	1.016	1.142	12	27.60	0.244	0.384	57	9.25
Michigan	0.929	0.951	2	23.00	0.550	0.613	11	14.80
New Jersey	2.085	2.120	2	51.10	0.243	0.487	100	11.75
New York	0.861	1.653	92	39.90	0.599	0.615	3	14.85
Ohio	0.615	0.745	21	18.00	0.403	0.515	28	12.40
Pennsylvania	0.671	1.035	54	25.00	0.372	0.530	42	12.80
Texas	0.622	0.760	22	18.40	0.087	0.170	96	4.10

Gas values, USBM.

opportunities for providing the "general industrial" group with some of the cost advantages, and with others in addition, are still considerable, though perhaps not as great as the utility and steel groups.

Oil Costs

Oil prices will continue to rise, but at a relatively slow rate. For example, No. 6 fuel oil, no sulphur guarantee, averaged $2.12 per bbl in New York harbor in 1950. In 1960, the average was $2.55. Since the prices on crude from the Gulf and elsewhere in the U.S., and from the Caribbean, will continue to rise because of increased production and other costs, No. 6 and other heavy fuels, of whichever origin, will continue to go up also. Thus the New York harbor price for No. 6 could reach $2.95 in 1970, or the equivalent of coal at $12 per ton, against the actual of $6 for coal itself in 1970. Even if heavy oil prices could somehow be kept down to today's levels, coal's differential would still increase.

The rise in the price of No. 2 fuel oil has been steeper in the New York harbor area, going from an average of 8.35¢ per gal in 1950 to 9.57¢ in 1960 (all oil prices from *Platt's Oil Price Handbook and Oilmanac*, a McGraw-Hill publication). As the rise continues in the future —as it will tend to do—the shift to gas and electricity will continue.

Oil therefore faces a king-sized dilemma in competitive pricing. There is no bounce in the gasoline market, reflected among other things by the fact that the industry's growth rate has dropped from 7 to 9% per year to half that or less. Attempts to increase or maintain revenue by raising gasoline prices would merely aggravate the sales problem. At the same time, coal on the one side and gas on the other is limiting sales of distillate and heavy fuel oil, as well as the opportunities for maintaining revenue by price rises to compensate for rising crude prices and processing costs. The need for revenue also inhibits attempts to reduce prices on these and similar products to build or hold business.

High tide for oil is past, though from the coal standpoint one very sticky problem remains. It is the dumping of by-product residual by foreign refineries. If they are willing to give the stuff away, it can come into the U.S. and coal is helpless to stop it through normal economic competition. Government import controls therefore become a necessity to prevent real damage to the coal and domestic crude-production industries.

Somewhat on the plus side is the conclusion that the situation is not likely to get much worse in the future, and might possibly improve. For one thing, if coal can achieve such low delivered prices as those previously discussed, the importers will find it harder and harder to get their required margin, expecially if there is any stiffening of residual prices at foreign refineries. It can be expected that there will be some pressure in that direction because crude costs are rising abroad as well as in the U.S., and the prices of the by-products tend to increase with crude increases.

Gas Costs

Delivered prices for natural gas today are a truly fascinating study, leading to most-interesting thoughts as to future possibilities. Bureau of Mines figures for the average delivered values of natural gas in sample states, including Texas, are shown for the years 1949 and 1959 in the accompanying table.

Looking at 1959 gas prices in terms of cost of equivalent coal, they range from $18 to $50 per ton for residential, and, except for Texas ($4.10 rounded off to the nearest nickel), $7 to $21.85 for industrial fuel. The first question is how something so cheap at the source can cost so much at the point of use.

The average value of gas at the wellhead in 1949 was 6.6c per MCF, equivalent to coal at $1.60. By 1959 wellhead value had risen to 12.9c, equivalent to $3.10 coal. Pipeline

Fuel Consumption and Prices

	New England	Mid-Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
1960 Fuel Consumption (millions of tons coal equivalent)									
Coal	10.2	91.8	161.6	23.0	55.0	43.0	1.1	8.5	2.3
Liquid fuels	44.0	88.8	56.7	20.6	48.8	7.2	22.5	10.1	33.3
Gas	5.0	45.3	79.5	51.2	31.8	28.5	186.7	33.6	55.6
Hydro	2.4	6.1	1.9	2.5	6.3	7.9	1.2	8.5	31.7
Total	61.6	232.0	299.7	97.3	141.9	86.8	211.5	60.7	122.9
1970 projected total	73.0	291.0	402.0	123.0	197.0	118.0	252.0	85.0	159.0
1959 Range of Delivered Gas Values, $ per Ton of Coal Equivalent									
Residential	$41.70-50.70	$25.00-51.20	$18.00-29.50	$13.55-23.40	$18.20-38.20	$18.05-24.55	$14.70-18.35	$14.60-31.15	$22.90-35.40
Industrial fuel	$15.60-29.50	$11.75-14.85	$ 9.30-14.70	$ 4.90-9.20	$ 7.10-16.55	$ 5.85-8.30	$ 4.10-4.75	$ 4.45-14.50	$ 9.10-10.25
Specimen Oil Prices, $ per Ton of Coal Equivalent									
No. 2	$28.25	$27.50	$27.00	$27.65	$27.60	—	—	—	$26.40
No. 6	$11.90	$11.95	$14.10	$ 8.30	$10.00	—	$ 8.20	$ 9.60	$ 9.65

Gas values, USBM; No. 2 oil, Bureau of Labor Statistics, April, 1961; No. 6 oil, *Platt's Oil Price Handbook and Oilmanac*, McGraw-Hill, 1960.

and distribution charges are the answer. The range in residential charges is particularly interesting. Ohio, one of the earliest states to use natural gas in some volume, obtaining it mostly from West Virginia, has a relatively low rate. Connecticut and New Jersey, among the last of the states to receive service, are up in the stratosphere.

Prices—field and otherwise—are still on their inexorable way up, in spite of governmental and judicial efforts to hold down the wellhead rates and certain other charges. The price situation, in fact, could be the Achilles heel of gas—or if not, might mean fairly soon a relatively substantial return to gas manufactured from coal or fuel oil in the consuming centers. These and other possibilities are analyzed in more detail in other later sections of this study.

High tide in natural gas may be nearer that one might think.

The Market-Potential Prize

The accompanying table shows in capsule form the prize for which the fuel industries will be fighting in the days to come. The impressive thing about this tabulation is the total quantity of liquid fuels and gas now selling in coal territory at way above even present delivered prices for coal, let alone the prices that coal can expect to achieve in 1965 and 1970.

Convenience and glamour are the big factors, especially in the residential market but also to some extent in the industrial-fuel market, though here the type of equipment in the user's plant and sacrifice sales are big factors. It would seem that even convenience and glamour, however, should concede something to cost, though a more-promising direction for coal would appear to be offering the user even more convenience and glamour along with the price. If coal can pull it off, there are a lot of millions of tons it can get back in the years ahead.

The Retail Trade

A popular and logical approach to the problem of forecasting probable demand is to consider coal category by category. One can start with retail deliveries, which totalled 30,405,000 tons in 1960 according to the USBM. Corresponding anthracite deliveries were 7½ million tons, aside from local sales.

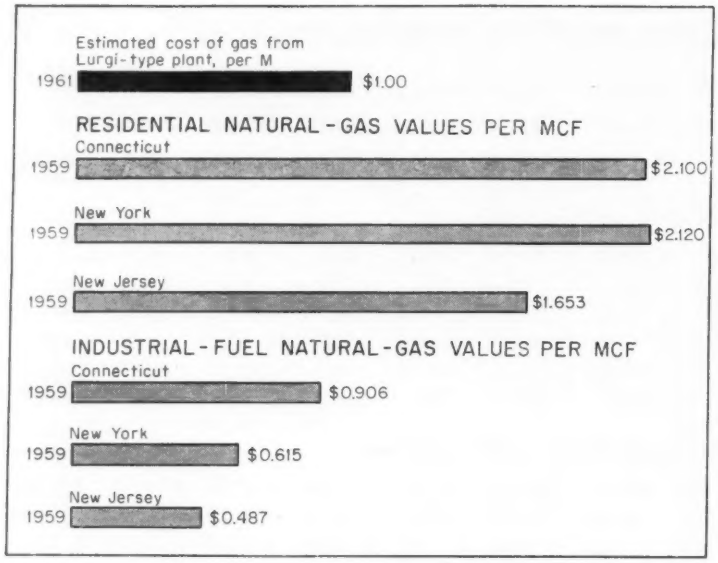
Involved in the future of retail deliveries are not only direct competition from oil and gas but also the extent to which electricity will change the picture. Everything considered, the future is one of additional decline—perhaps to 15 million for bituminous by 1970, though there is some opinion that retail may prove a better stayer than might be expected.

Industrial Consumption

Coal consumption in various divisions of the "general industrial" group in 1960 was as follows:

	Thousand Tons
Steel and rolling mills	7,378
Cement mills	8,216
Other mfg. and mining	76,487

Oil and natural gas figure heavily in fuel usage by these groups. Natural gas used in making portland cement in 1960 was about the equivalent of the coal consumption, or slightly over 8 million tons. Oil use



OPPORTUNITY FOR COAL? — The estimated price of gas equivalent to natural gas as of today, using Lurgi-type equipment, compared to residential and industrial-fuel values for the natural product in 1959.

by the cement mills was the equivalent of around 1¼ million tons.

Cement is a growth industry and coal will grow with it. If it holds its own, the figure should be 11 to 12 million in 1970. But if it can increase its share in the territory it can serve, it can go up to 16 to 18 million.

Oil and gas have cut consumption by steel and rolling mills very sharply from its peak of 19 million in 1936 to 7,378,000 tons in 1960. Is 19 million or more possible in 1970 if coal can make headway against the competitors, primarily on the price basis? Possibly not but it perhaps could be accepted that there is a potential of 15 million or more.

A welter of different types and sizes of industries and establishments make up the "other manufacturing and mining" group. Convenience, glamour and elimination of coal and ash-handling, as well as some saving in labor, have been the major arguments of first oil and then gas. They have been effective, especially since coal had almost nothing in the line of a fuel-burning unit that could provide substantially the same convenience, glamour and labor reduction. It now has at least one and the ground has been laid for a comeback in this market if coal presses its equipment-development program as well as its sales and service efforts.

Of the total 1960 consumption of liquid fuels east of the Mississippi, equivalent to 245 million tons, around 100 million tons represented heavy fuel oil, a considerable portion of which was used in general manufacturing in addition to utility firing. A significant chunk of the distillates and other light fractions also went into the commercial and industrial markets. The price situtation is favorable to coal if the other preference points can be matched.

An unknown in the general industrial picture as far as direct fuel use is concerned is how much will switch to the electric utilities. Any switching probably will not be major in extent. There is relatively little nonutility generating capacity left (less than 10%) and even if it could be switched it still would mean some coal use. Aside from electric power the big needs of general manufacturing and commercial establishments are process steam and heat. Very little of this can be switched to electricity according to today's thinking, though the situation could change. Therefore industrial and commercial establishments will continue to use the fossil fuels about as they do now.

Total fuel use will increase. With prices already in its favor, and with further development of equipment for this market and further sales and service work, coal should be able to increase its share in the future at least moderately and perhaps substantially. The peak for "other manufacturing and mining industries" was 142 million in 1943, double today's figure. By 1970 coal should be able to knock off enough gas and oil, in addition to benefitting from expected growth, to get back to 110 million or better in this category.

The Railroads

Few people are inclined to think that the railway locomotive will ever burn coal again. But is this necessarily so? Prospects are not too sanguine, in view of the failure of the first attempt to build a coal-fired gas turbine. Ash was the villain, but metallurgical and materials developments may make possible the construction of a standard turbine or, failing that, something perhaps embodying the Tesla-design principle. Again, in terms of cents per million Btu the situation favors coal. However, if a change takes place it may not be soon enough to result in much railroad business in 1970. Assuming successful development of a coal-fired turbine, it also would open up prospects of increased business in the marine field.

Coke and Char

The coke and char market probably is in more of a state of flux at the moment than any other. Oven and beehive plants consumed 81 million tons in 1960. The majority went for blast-furnace use, but reduction of other metals and the pro-

duction of chemicals provides other growing outlets. The total for coke and char for chemical processing, for phosphorous reduction, for pelletizing and so on 10 yr from now is necessarily difficult to predict. But on the basis of plants already operating and known prospects for others, these forms of coke and char could represent markets for all the way from 10 to 20 million more tons of coal in 1970.

Blast-furnace coal use could be anything from a considerable drop to a considerable advance in 1970. Steel production will increase at a rate paralleling the growth in the economy but coal consumption will be subject to the pulling and hauling of the following:

1. Further increases in furnace efficiency. These could be substantial over the years even if there were no changes in the basic approach.

2. Substitution of other fuels for coal as a result of development of new techniques. As an example, natural gas, fuel oil and powdered coal are being fed into the furnace reaction zone to improve capacity and efficiency. It seems likely that this will be general practice, and the choice of the fuel will again be largely on an economic basis—in other words the cost of coal at the furnace pulverized and ready for injection vs. the price of heavy fuel oil or natural gas. If coal should lose, some see it losing as much as 30% of its furnace tonnage. For the present, at least, it can be assumed that it will win in the area where it is readily available. For the steady pull price is in its favor.

3. The establishment of substitute processes—the various forms of direct reduction, for example. These are not likely to be a significant factor in the next 10 yr.

Guesstimating on steel use of coke is, as intimated earlier, complicated by the fact that possible technological breakthroughs may radically change the picture. But assuming 125 to 130 million ingot tons of steel in 1970, coal for furnace, foundry and kindred uses could total 80 million tons or more, though there is also the possibility that it could be much less if some of the coming battles were lost.

Utility Coal—Star Performer

The electric utilities of the U. S. themselves, in reports to *Keystone Coal Buyers Manual*, a *Coal Age* affiliate, forecast an increase in coal burn of 63 million tons in 1965. This would bring the total to around 230 million tons, compared to 176.5 million tons in 1960, including some 2½ million tons of anthracite. A similar increase between 1965 and 1970 would raise total 1970 use to around 300 million tons.

This total—or more likely an even higher one up to 325 million tons—reflects the fact that consumption of electricity will double or more in the next 10 yr. *Electrical World*, a McGraw-Hill publication and an authority in the field, forecasts total power sales of 1.5 billion kwhr in 1970. Generation in 1960 was almost exactly half, or 0.753 billion.

From this total some calculations can be made as to possible coal burn in 1970. First, the hydro percentage probably will drop to 15% or so from its present level of 20%, since there are now few opportunities for increases in generating capacity. The nuclear percentage in 1970 still is a guess, but it is difficult to see any number of plants of any size in operation at that time. Therefore, the nuclear percentage probably will not be over 2%.

Some 83% of the 1970 total therefore should be generated by coal, oil and gas. At a rate of 0.7 lb per kwhr, compared to 0.877 in 1960, fuel requirements would total 435 million tons. If coal's share was still 65% its market would be 293 million.

This 293 million probably can be considered rock bottom if the economy, the population and the use of electricity per capita grows as expected. Actually, there is good reason for forecasting a larger fossil-fuel and specifically a larger coal consumption by the utilities. For one thing, there is the possibility that the use of electricity may accelerate above present estimates. Second, coal stands a very good chance of improving in percentage in relation to oil and gas.

Switching just one-eight of the gas burn in all areas but West South Central, Mountain and Pacific would raise the coal percentage on the basis of 1960 usage to 70%. This one-eighth would have represented 9 million tons in 1960. And there is nothing in the picture to indicate that coal cannot gain ground even in the predominately gas and oil territories. The two new Arizona generating plants are evidence that this is very much in the cards.

It can be accepted, therefore, that coal's percentage in 1970—or even earlier—should go to 70 or better. At 70%, coal tonnage in 1970 would calculate out to 305 million; at 75%, 327 million.

All the preceding is based upon nobody coming up with a "little black box" that would radically alter the present utility basis of growth. Fuel cells, for example, are becoming almost a dime a dozen and there are other ideas. It is highly unlikely that they will be able to supply electricity as cheaply as a central station can turn it out, though they can serve a number of military and specialty uses very nicely.

The natural-gas industry, as a matter of fact, is now embarking on research to develop a fuel cell. It already has in operation in one or two spots an earlier "black box." It is a gas-fired turbine unit for individual applications, such as, a shopping center or individual plant. The turbine turns a generator to supply electricity, while the exhaust is used to supply space heat. The idea is practical—if the gas rate is right. The gas situation now and in the future is such that it is difficult to see how the rate could be right if the units were used in any number.

One major question is whether the nuclear percentage will be more than 2% in 1970. The lowest estimate up to now for nuclear cost—the plant is still only in the planning stage—is 5.32 mills per kwhr. This is almost competitive with coal at $11 per ton, but a long way from being competitive with an expected delivered cost in, say New York, of $6 or a mine-mouth figure of $4 or less.

Exports in 1970

It can be assumed in looking at what may happen in the years ahead in exports that if the Communists

Oil From Coal—When?

Gasoline can be made from coal, if necessary, according to officials of the Esso Research & Engineering Co., Linden, N. J. However, say these officials, known supplies of petroleum world-wide are bigger today than they ever have been, and the prospects for supplying the continually increasing demands for generations in the future are good. And in North America, especially, if supplies of petroleum were to become limiting or too high priced, they could be extended manyfold over presently proven oil reserves at little increase in cost by the development of oil shales and tar sands.

Coal is the biggest fossil energy reserve both in the U.S. and worldwide. Scattered through 29 states our coal reserves are estimated at about three trillion tons. Even assuming that only part of this would be available for production of synthetic gasoline, the potential gasoline production from coal can be measured in the trillions of barrels. This compares with present gasoline consumption of about 1.3 billion barrels per year. Thus, our coal reserves could keep us supplied with gasoline at the present consumption rate for 1,000 yr.

Coal can be converted to gasoline either by hydrogenation or by synthesis. Of these, synthesis is cheaper, but the cost of gasoline even by synthesis is considerably greater than from conventional crude sources. In synthesis the coal is ground to a powder before it goes into a gas generator where it is converted with oxygen and steam to produce a "synthesis gas" of carbon monoxide and hydrogen.

The use of "fluidized" coal for gasification has been found to be advantageous just as is the use of the "fluid" catalyst worked out by Esso Research & Engineering for catalytic cracking. Natural gas can also be used for manufacture of the synthesis gas, but once the synthesis gas has been obtained, the rest of the process is the same. The synthesis reactor converts the synthesis gas into oil, again using the fluidized-solids technique.

A considerable amount of work was done in the years following the war on development of the hydrocarbon synthesis process. At the present stage of its development, synthesis from coal would produce about 100 gal of gasoline and diesel fuel, or roughly 2.5 bbl, from a ton of coal. In other words, a daily production of 10,000 bbl of synthetic liquid fuel calls for a daily feed of the order of 4,000 tons of coal. An annual production of a billion barrels would require 400 million tons.

For the highly competitive American market, hydrocarbon synthesis from coal is not now attractive commercially, but it represents a potential reserve of synthetic gasoline larger than all other sources.

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want to take the market in western Europe—and Australia, China or India the Japanese market and others in the Pacific—they can. All that the U.S. can be reasonably sure of is North and South America. If that should be it in 1970, the foreign business for U.S. coal probably would be 15 to 20 million tons.

New Uses

The major new uses for coal that might involve significant tonnages are:

1. Synthetic liquid fuels.
2. Synthetic gas.

Both synthetic liquid fuels and gas have been produced for many years abroad. They undoubtedly will be produced in the U.S. The question is "When?" and the answer is primarily economic. In other words, when will synthetic cost the same or less than natural, whether gasoline or gas?

Heat loss in the process is the major factor in achieving a low synthetic gasoline cost. Sometime ago, this loss was 50 to 55%. Now, it seems logical to expect that in a new full-scale plant some 60% of the heat content could go into gasoline and other salable products. This would mean a significant improvement in the cost picture. The 15 million Btu in the final product is equivalent to 114 gal of gasoline, though, of course, there are products other than gasoline—diesel fuel, for example.

In 1960, according to *Platt's Oil Price Handbook and Oilmanac,* a McGraw-Hill publication, averages of high and low prices for regular-grade gasoline were as follows in three selected areas:

	Cents per Gal	Revenue for 114 Gal
Oklahoma points	12.47	$14.22
Chicago	12.04	13.73
Oil City, Pa.	13.25	15.10

The difference between a coal cost of, say, $4 at a mine-mouth plant or one close by, and receipts at this gasoline rate, or even a cent or two less on the average, should provide room at least for figuring. If the coal price was $8, including transportation to a distant plant, the margin might be a little thin, unless terminal price were 15 or 16c a gallon or better. In any event, the day when gasoline could be made from coal on a competitive basis is fairly near in certain areas, and it would not be surprising to see plants running by 1970. And even one plant chews up a lot of coal.

Natural-gas rates in areas such as Connecticut and the Mid-Atlantic states are such even now as to invite consideration of the substitution of synthetic gas. One possibility is Lurgi-type plants, the latest of which is now being built in Great Britain, following one in Australia and two in Germany. Experience abroad and calculations in the U.S. indicate that a full-scale commercial operation could turn out gas equivalent to the natural product, with coal at $8 per ton and a reasonable return on investment, at around $1 per MCF. The average value of natural gas for residential service in Connecticut was $2.10 per MCF in 1959; for industrial fuel, $0.906. In New Jersey the rates were $2.12 and $0.487; New York, $1.653 and $0.615.

As previously noted, $6 coal in New York and lower Connecticut is the likelihood in 1970, which would improve the economics for synthetic. The conclusion is that some synthetic plants will be built and operating in 1970.

Guessing at the sizes of industries not yet in being is perhaps uncommonly hazardous, but 1970 might see plants using 15 million tons of

Gas From Coal—When?

Dr. Martin L. Elliott
Director, Institute of
Gas Technology

ANY ESTIMATE of the time when supplemental gas produced from coal may be needed can only indicate a period in the future covering a fairly wide range of calendar years. This uncertainty is inevitable because such estimates are based on factors which in themselves are also estimates with inherently high uncertainties. These factors include:

1. The future ultimate recovery of natural gas.

2. The future deliverability of natural gas.

3. The demand for gas in the future.

In addition, the effect of developments in transporting and storing liquefied natural gas in making available new sources of supply cannot be evaluated at this time. Finally, it must be recognized that estimates made for the U.S. as a whole are useful only as a gross overall guide, since conditions will be different for each region or local area.

Projections of natural gas deliverability indicate that, with a growth in demand of about 3% annually, supplemental gas would be required after 1970 or 1980. Since the development of proved large-scale processes will require as much as 10 yr after completion of the present pilot-plant program, we cannot be complacent about the adequacy of the lead time for developing supplemental gas-production processes.

There are two basic methods for the production of high-Btu gas from coal:

1. Gasification with steam and oxygen to produce synthesis gas, consisting primarily of hydrogen and carbon monoxide, which is purified and catalytically converted to methane (methanation).

2. Destructive hydrogenation (hydrogasification) at high pressure. In some process schemes, hydrogasification may not directly produce a gas with a heating value of at least 900 Btu/SCF. Therefore, a methane-hydrogen separation step and hydrogen recycle may be required. Process hydrogen is produced either directly or indirectly by gasification of some of the coal or residual char.

Combinations of hydrogasification and methanation also appear promising; in this case, steam-hydrogen mixtures would be used for gasification.

Methanation of synthesis gas has been developed to a large pilot-plant scale and would require relatively little additional work before commercialization. The various high-pressure hydrogasification processes now are under active pilot-plant development, and sufficient data are already available to predict the most likely process schemes and product gas characteristics.

Economic analyses or cost estimates, even though preliminary, are essential in guiding process-development work. Several such estimates have been made by a number of organizations. Broadly speaking, they indicate that the cost of gas by the methanation process ranges from $1 to $1.25 per million Btu (MMBtu), and by the more promising hydrogasification processes, from $0.75 to $1 per MMBtu.

In connection with these estimates, several factors should be recognized. First, they are based on today's technology. Several potential process improvements are under consideration, but have not as yet been evaluated technically or economically. In addition, development work on synthesis gas and hydrogen production processes is in progress in the U.S. and abroad. Since the cost of synthesis gas and hydrogen represents about 55 to 65% of the cost of the finished gas, it is evident that advances in basic gasification processes will have a marked effect on the economics of pipeline gas production.

Second, even with production costs based on today's technology, gaseous fuels produced from coal and distributed to the ultimate consumer would be in a very strong competitive position with electricity produced from coal. This is illustrated by the following comparison of production-plant investment cost, conversion efficiency, and distribution cost, based on 1958 data:

	Gas From Coal	Electricity From Coal
Plant Investment Cost:		
$/MMBtu daily capacity	800-1,000	1,800
$/KW		150
Conversion efficiency, %	65-75	45†
Distribution cost to residential customers, $/MMBtu	0.60	5.36
Average cost to residential customers, $/MMBtu approx.	2.00*	7.42

†Probable maximum, conventional plants.
*Including storage to maintain high load factor.

Even with allowances for differences in utilization efficiency, it is evident that synthetic pipeline gas is in an excellent competitive position with electricity generated from coal.

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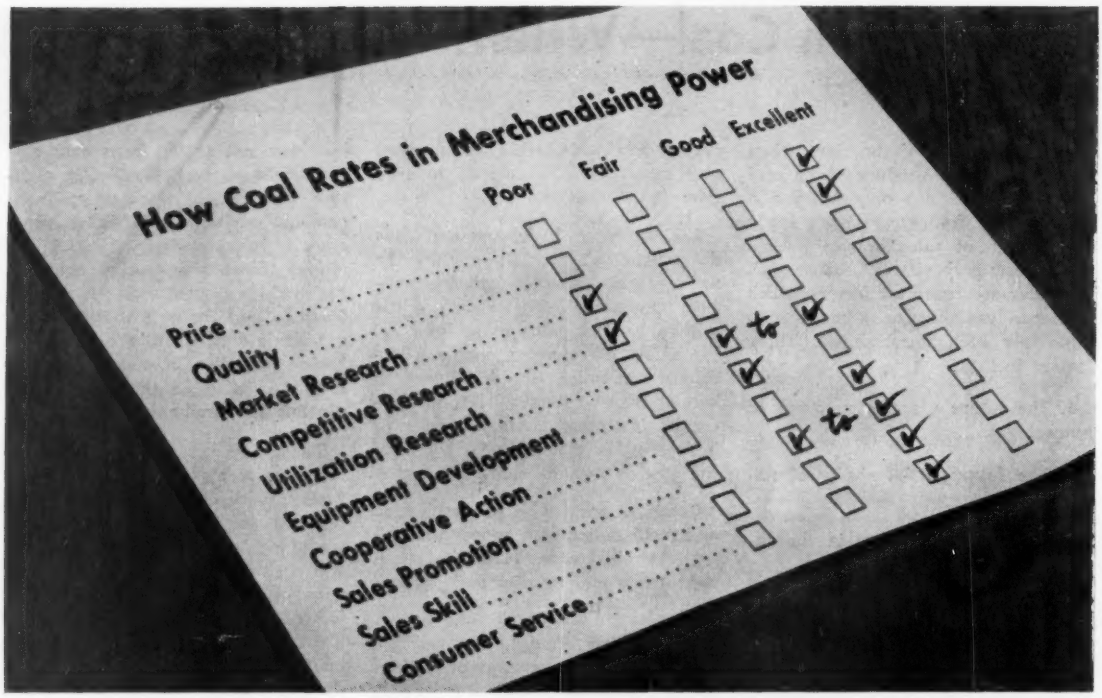
coal for gasoline (100,000 bbl per day) and perhaps as much or more for gas, in 1970.

The 1970 Potential

On the basis of the previous analysis, perhaps a conservative estimate of the potential for bituminous coal in 1970 would be as follows:

Railroads	5,000,000
Retail deliveries	15,000,000
Exports	20,000,000
Coke and Char	100,000,000
General industry	140,000,000
Electric utilities	315,000,000
Synthetic liquid fuels and gas	30,000,000
Total	625,000,000

If total population and energy use should increase, if exports held to around present levels, if coal's share of the utility market exceeded 75%, if synthetic production should be larger than now thought, or other favorable breaks should occur, a rate of 650,000,000 tons or better could mark 1970 or some year close to it.



Merchandising . . .

Key to Maximum Sales Growth

If one accepts the conclusions arrived at in the discussion of competition and the future outlook for coal in the preceding article in this Golden Anniversary Issue of *Coal Age*, the conclusion is that it will be hard to avoid selling more coal in the days to come. In fact, it will be well-nigh impossible. The problem is attaining the maximum in sales that the future holds—and it is a major problem. In other words, what must coal do to cash in to the utmost on its growing cost and quality advantages?

In contrast to the earlier years of the past half century coal is now really doing some merchandising, though it still has considerable ground to make up. But it now has an appreciation of what the job requires and the will to get on with it. In and for a time after the depression following World War I, it seemed at times as if merchandising emphasis more often was on seeing, after a meeting and a solemn compact not to sell below a certain minimum, how soon one could get to the phone to cut the price.

It is granted that this may be a somewhat exaggerated picture, though not too much so. Perhaps the greatest gain from that depression and the economic blood-letting that accompanied it was a realization by management representing the majority of the tonnage that selling below a price that would provide a fair profit was a good way to commit corporate suicide. With this realization came the parallel realization that good merchandising was essential to make the most of market opportunities.

Merchandising's Status Today

How far has coal come, as an industry, in developing the necessary merchandising approach? And what more is necessary to meet the challenge of the coming growth era—getting the maximum return from the undeniable opportunities of the days ahead?

The chart at the start of this article is one view as to where coal now is. Others may feel that the check marks should be placed more to the favorable side, or perhaps the unfavorable. However, though some individual companies score much higher, it cannot be accepted

tnat the industry as a whole can rate "Excellent" all along the line.

But there is no question about two of the elements that go into a fully-rounded hard-hitting merchandising program. They are cost and quality. In both these departments coal has done marvelously well—and it is continuing to improve in both respects. Elsewhere, the top in ranking is "Good," with the bottom in at least two instances "Poor." The job for the future is to advance everything to "Good" or "Excellent," with the majority rating "Excellent."

Market Research

A prime objective in market research is find out where the possible customers are. Only thus is it possible to take the first step leading to a sale. Such research is fairly simple when it comes to utility plants, steel plants, cement plants and the like. It becomes a considerable problem in the "general industrial" field, which represents a big actual and potential market now and also in the future. However, until the job is done, in this and other market areas, a big gap will continue to exist in the coal-merchandising front.

Competitive Research

It is a fair bet that competition probably knows and trades more—much more—on coal's weaknesses while trying to bury its strengths under the rug than vice versa. It is axiomatic that attaining maximum effectiveness in merchandising power requires knowing what competition can and cannot do. In fact, the crack merchandisers usually will say that the goal is knowing competition better than it knows itself. Then you can attack where it is weak and bypass its strong points.

What can competition offer price- and quality-wise now and—equally important—in the future? What does it have in special qualities, such as the convenience of gaseous or liquid form—and is there any way coal can provide an even better substitute, such as, electricity? Or can coal provide the same products using its own products as the raw material? In other words, can it compete directly and win? This is a real, live question at this moment, since it now appears that liquid fuel and gas from coal would be almost if not actually competitive in certain areas.

Coal certainly has the price advantage in all but remote areas from the mines. And it is getting into position to offer equal convenience and the like. When competition's strengths and weaknesses in these and other areas are known, then the stage is better set for getting coal accepted.

Utilization Research

Coal as an industry is relatively a Johnny-come-lately from the standpoint of research into coal utilization and coal-burning equipment. The establishment of the Anthracite Institute Laboratory in 1930, and the organization of Bituminous Coal Research, Inc., 1933, marked the first beginnings of organized industry-sponsored research on any appreciable scale.

Before that the two industries could only hope that government universities and colleges, equipment manufacturers looking for new opportunities, and consumers would do the job for them. They did in part—and still do—but growing realization that coal could expect maximum results only if it set up and operated its own facilities culminated in the actions previously set down.

A difficulty at the start of the programs was limited funds. It still is the major difficulty in spite of the fact that coal's record for getting the most out of research monies easily bears comparison with that of any

Sales and Research . . .

"Basic Ingredients"

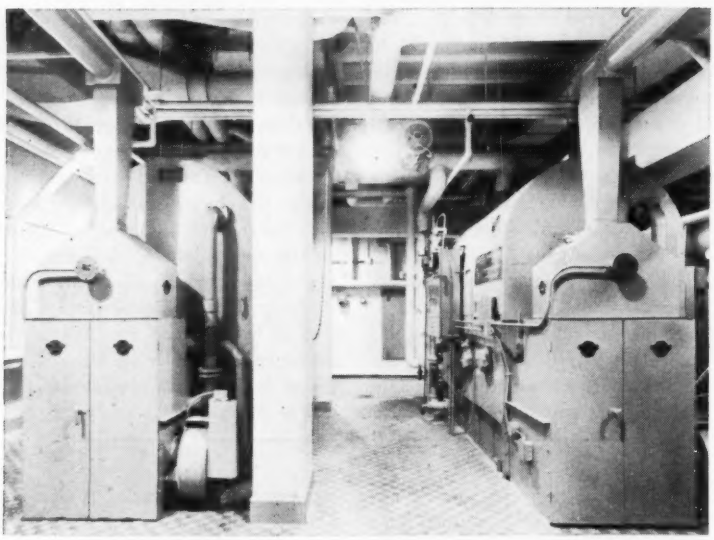
Thomas Kennedy, President, United Mine Workers of America, June 26, 1961, Rocky Mountain Coal Mining Institute

These then are the basic ingredients of the future for the coal industry, and the coal miners who work in that industry. You will note that we regard the health of the coal industry and the welfare of the coal miners as closely related. This, to our minds, is basic economics. For if coal prospers, our men work, receive high wages and enjoy all the other advantages of prosperity. Conversely, if the coal industry staggers along at a low rate of production, the coal miner suffers all the hardships inherent in the depression of an industry. Consequently we regard as the province of our union the sales and marketing structure of the coal industry and are engaging, and will continue to engage, in legitimate activities to promote increased utilization of anthracite and bituminous . . .

The second major responsibility [after attaining an National Fuels Policy safeguarding the legitimate interests of coal] that we in the coal industry must undertake is the establishment of an adequate research program. To our minds, no other single program offers so much hope for the future of the coal industry . . . For many years the coal industry has been extremely lax in research activities. At the same time our competitors have been very active. Oil, for example, spends over $300 million on research each year. Coal, on the other hand, spends only $17 million, and most of that is spent by organizations other than the coal operators . . .

The United Mine Workers believe that the coal industry must undertake a research program which will parallel the trend in research by our competitors and the general economy. The industry must realize that the only way to grow—and grow we must—is through the process of innovation, of change. It is truly a wonderful world for those who are willing to accept the challenges of the decade—the challenge of the test tube and the rocket, the challenge of the unknown, the challenge of the area that knows no boundaries but the skill and daring of the mind of man. This is the challenge that the United Mine Workface in the 60s and 70s. This is the challenge that the United Mine Workers of America has already accepted and is determined to carry on.

Modern Laboratory Facilities . . .



Key to Modern Burning Equipment

Future expansion of laboratory facilities, such as this new BCR installation—a No. 1 job for coal—will speed up the development of efficient, clean and laborless burning equipment, and thus increase the acceptance of coal in all markets—especially commercial and general industrial.

other industry. But the situation has improved, and should improve even more when the new BCR laboratory at Monroeville, Pa., gets into operation.

Equipment Development

The role that equipment plays in establishing the market for many products, including coal, probably still is not appreciated fully by coal. The point becomes painfully apparent when one considers the headway that competition has made in "general industry" in spite of the significant price advantage in coal's favor.

The biggest part of the answer is in equipment. Oil and gas, and the equipment manufacturers, came up with the packaged boiler. Coal had nothing comparable—and therefore no argument but savings, which possible purchasers almost invariably swept aside under the hypnotic influence of the oil or gas salesman. Consequently coal almost invariably lost the battle—and still does, though not to the same extent.

Equipment development was one of the first jobs of the Anthracite Laboratory and BCR—stoves, stokers, and so on. Some real advances were achieved, as in hay drying, for instance. But funds, and in turn, research and development manpower and laboratory facilities, were limited. Consequently it was not until recently that a competitive packaged boiler was evolved by the bituminous industry, which is on its way to becoming a market success.

Along with the lack of manpower and facilities for equipment development, incidentally, was lack of an organization to get it sold and installed. So, the researchers had to also become promoters—primarily to interest manufacturers in the possibilities, but in some instances to sell and service direct.

Cooperative Action

Total sales effort, in some books, requires the cooperative action of both management and men in the industry itself and a parallel effort by distributors of the product, the organizations that move it to the point of consumption, and the builders, sellers and installers of equipment that uses the product.

Coal management's record in signing up for cooperative action is good, though this could not always be said of the actions themselves. The old Committee of Ten—Coal and Heating Industries, set up in 1930 was an example of an organization taking in all interests. An example of a group involving management and men alone was the Committee of Twelve in anthracite. Today the cooperative organizations that deal in markets and marketing in whole or in part include the National Coal Policy Conference, set up in 1959.

Sales Promotion

As generally practiced, sales promotion includes a variety of activities paving the way for the call of

the salesman and the clinching of the order. All forms of advertising are involved, as well as informational publications, market-data files, engineering and application bulletins, plant-design data, operating manuals and so on. In other words, this classification includes all the steps normally leading to getting a possible purchaser in a mood to listen when the salesman gets there—and scarcely less important, perhaps, keeping him feeling that his bargain is a good one.

Promotion has been done on up to a major scale by many companies for many years. Organized effort in the anthracite began in 1936 with the formation of Anthracite Industries, Inc.; in the bituminous industry in 1938, when National Coal, with the cooperation of the American Wholesale Coal Association and the UMW, initiated a nationwide promotional program. Now, the responsibility for such work, under the NCA reorganization plan of 1960, resides in the BCI Market Promotion Div. of the NCA Marketing Dept.

Sales Skill

A representative who knows his business is one of the key elements in sales effectiveness. There is such a thing as a natural-born salesman who can handle practically any product and do well for himself and his company. But normally the good salesman must be created—meaning that he must be carefully selected and then given the training necessary for effective functioning on the firing line. Past experience has indicated that a good knowledge of coal, its characteristics and how to use it, and of competition and its advantages and disadvantages, are real assets.

Formal training courses instituted by the bituminous industry several years ago, now the responsibility of the Manpower Development Div. of the NCA Marketing Dept., and also the courses of individual companies, are increasing the supply of skilled coal salesmen.

Consumer Service

Help for the customer when he or she needs it is a vital ingredient in all effective merchandising plans. Trouble can always be expected, along with questions. Prompt response by competent people keep trouble to a minimum and promote satisfaction by providing immediate answers to any questions that may be posed.

Fuel engineers have been active in coal for many years, though they were not too numerous. Industry efforts to provide consumer service goes back, in the case of bituminous, to the organization of Coal Heating Service in 1946. Before that, regional agencies, such as, the Fairmont Coal

Market Research . . .

"The Vital Link"

Rex Chaney, Director of Public Relations, National Coal Association convention, June 8, 1961

We know there are many more such potential users of coal. We don't know just how many . . . we don't know where all of them are located . . . but we must find out who they are and where they are if we are to realize our 500-million-ton goal.

How do we obtain this information? Through an intensive scientifically conducted market-research program. Market research will pinpoint our potential markets. Then, and only then, can we logically develop the most-effective publicity and advertising program to reach our potential customers.

Technical Research . . .

"Vital to Expansion"

James R. Garvey, Vice President and Director of Research, Bituminous Coal Research, Inc., National Coal Association convention, June 8, 1961

We believe technical research can play a vital role in enabling the coal industry to expand the demand for its products. Technical research can be the first link in the chain we must forge—a chain strong enough to support the coal industry's efforts to reach 500 million tons in the near future. But we must all recognize that if we depend solely upon the efforts of our laboratories, whether they be those of individual companies, the industry's general research agency, as represented by BCR, or those research groups sponsored by funds from the Office of Coal Research, we are destined for disappointment.

We urge that the coal industry take a close look at the overall effort necessary to increase coal sales and recognize, as other industries have, that research is only a part of this effort. Research, to be fully effective, must be joined by appropriate public-relations and marketing action.

And in our eagerness to use research in its accepted but misunderstood role as creator of new markets, we must not overlook its equally important function, namely, to enable capture of already-existent markets. No matter how optimistic we would like to be, we must conclude that coal's basic value in our modern industrial complex is as a source of heat energy.

It is true that coal is a wonderful chemical and as such is a basic raw material having tremendous future potential. But we must be realistic and recognize that unless we prosper from the current uses of coal where it has economic advantages, we will not as an industry live long enough to reap the benefit of future potentials. Today we are selling heat energy. Some day we may sell methane, naphtha, gasoline, etc., and the other valuable chemicals which can be derived from coal. Certainly, a part of our research should be directed toward this dream of tomorrow. But let us not ignore today's markets which are the basis for our existence now.

The four areas of potential expanded coal sales are today's coal markets—the heat-energy market.

Marketing . . .

"It Still Has to be Sold"

W. W. Bayfield, Vice President—Marketing, National Coal Association convention, June 8, 1961

Let's assume we have developed the equipment, that qualified manufacturers are ready to build it, that we know the market, and that our potential customers have been informed of coal's progress.

Do we need more?

The question can be answered by posing another question: Of what use is the creation, manufacture of and publicity about new pieces of coal-burning equipment if no one buys it?

No matter how well a potential market has been conditioned, it still has to be sold. As you know so well, every customer now operating a coal-burning plant is well acquainted with the names and locations of dozens of coal companies but, despite this fact, you are not besieged by buyers. On the contrary, you maintain aggressive sales organizations to persuade existing coal consumers to buy your particular coal.

Today we are considering a much more difficult assignment—that is, to convince a noncoal user that it will be to his advantage to burn coal . . . This is tough selling. It is creative selling. It is making a market for coal where none now exists. Every one of you has tried it. You know that it is a lot harder to sell an idea than a product. After all, a plant now using coal is going to buy it from someone, but a noncoal user must first be persuaded to use coal . . .

Our potential customers can be shown that the use of coal can satisfy their needs better, and more economically, than any other fuel. If this sales job is to be done well, it must be done by highly trained men, men who know their business, men who can effectively prepare and present a complete comparative cost analysis, men who can answer all the questions, men who can furnish a prospect with all the necessary information . . .

The twofold task of fighting to retain markets we now enjoy and aggressively pursuing new markets also needs the active cooperation of your qualified sales and engineering personnal. This job, too, needs increasing cooperation from our coal-carrying railroads and, in some cases, the help of progressive retail coal merchants. Our industry must mount a well-planned and well-coordinated attack with participation by all who have a stake in the future of coal . . .

When promoting the use of coal we must of necessity promote the installation of coal-burning equipment. So we will also need the active cooperation of manufacturers of coal-burning equipment or their representatives . . . When a potential customer asks where he can get the necessary equipment, we have to be able to tell him. Some say it is not our responsibility to promote coal-burning equipment—that it is up to the manufacturer. But, gentlemen, let's be realistic. Our competitors don't think that way . . .

Now, in our efforts to promote the use of coal, the potential customer will also ask who is going to supervise the installation of the equipment, start the operation, train his people in its use, provide prompt service when it is needed. We must have the answers—better ones than today . . .

The final important answer involves the financing of the equipment . . . Normally, the lower operating cost of coal will enable the consumer to recover the extra capital investment in 3 to 6 yr. However, this fact often will not be accepted on its face, but even when it is, the relatively high initial cost is a handicap which we must overcome. The potential buyer wants to know where the money is coming from. We must make it as easy as possible for him to acquire the means of consuming our product. Our competitors do just that.

Bureau and others, had hung up creditable records in certain markets.

The present industry service setup, under the jurisdiction of the Market Promotion Div. of the National Coal Association, carries on the earlier work.

The Merchandising Future

Development of a streamlined and effective organization to head up its merchandising efforts has been one of the big achievements in recent years in bituminous coal, and also on a more-limited scale in anthracite. Under one roof and one direction—National Coal Association and the Anthracite Institute, respectively—the way has been cleared toward maximum progress on all fronts. But the big need now is, as it long has been, more money. Action in other directions should include the following:

Market Research—Early completion of the planned census of all fuel users, large and small, should be high on the must list. The aim should be to have on record, by name and address, every fuel-burning installation that coal could possibly serve, now and in the future. A second objective should be the setting up of machinery to obtain and distribute information on all plans for construction of homes, business buildings, factories, institutions, and even boats and ships, so that coal can present its story before the door is barred.

Such research is logically an industry organization job and in bituminous it is the responsibility of the Market Promotion Div. of the NCA Marketing Dept., though individual companies should have their own programs as well.

Competitive Research—Until the industry is sure that it knows everything it should know about its competition, including what its prospects are for providing the same products now or at some future date, the competitive research job cannot be listed as completed.

This again is a joint job, though primarily one for the industry organization.

Utilization Research—Coal is the first to admit that its research job is inadequate—and that it will not realize its full market potentials as long as it relies on others to carry the majority of the load. A conscious effort must be made to improve and extend research activities—at the earliest possible date. If nothing else, the potential in synthetic liquid fuels and gas, or in recovery of the railway fuel business, warrants a major stepup in the work being done by the industry.

If one is pressed to say what the level of expenditure should be, this is it: at least triple the present rate. Even more is well warranted.

This is a matter for individual-company decision. The nucleus of an industry program already is in existence and those directing it are eager to embark on an expanded one offering a major increase in benefits over the years. Of course, anything done by individual companies will increase the total impact in the market place.

Equipment Development — Coal has suffered severely and still does because of lack of development of modern burning equipment for a number of markets. The problem is not a critical one in such markets as utility, heavy industrial, coking, etc., because the price and other qualities of coal give it the edge and in turn lead the user to develop equipment and burning methods to reduce his consumption to the minimum and thus extend his savings.

But in other markets such things as equipment availability, convenience, cleanliness and the like become important factors—and here coal's record has not, up to now, been good. Availability was a major factor in the use of the diesel in the railway market, though smoke and handling coal and ashes also were involved, along with the ancient age of the locomotives themselves.

No one can say that if coal had gone to work much earlier to develop efficient firing facilities, or a different type of power plant for locomotives, it could have kept the diesel out. But by the same token it cannot be accepted that there is no chance of coming back in the railroad field with the coal-fired turbine or some other coal-based power plant.

After the railroads, the "general industrial" market was where coal had its next greatest difficulty because it could not offer competitive equipment—for example, a packaged boiler.

The job is a big one and, though a start has been made (the Coal-Pak, for example), it is only a start. A decision is involved. Should coal do its own development, or should it try to get people already in the business to do it? It hasn't had too much luck in the latter respect in recent years, but the outlook is improving and a serious missionary effort could improve it even more.

But coal still must be prepared to supply the spark, and it quite probably will involve for a time at least for the carrying out of its own development program. If so, more money is needed here also, though it can be accepted that if the research program is stepped up the equipment-development program will go up with it. Again this boils down to a decision by an individual company to put up more money to achieve the program the industry should have.

Of course a new development in equipment accomplishes nothing if it isn't sold. This still is a problem. Should coal depend on independents to take over and push a coal development? This is assuming that the independent has not done his own development. It is, as noted, a real problem, and coal may well have to give serious consideration to the establishment of its own equipment sales and service organization to handle not only its own developments but also any other equipment that will insure a market for its product. A precedent already exists in the operations of Bituminous Coal Equipment, Inc., formerly Atuomatic Solid Fuels Equipment, which became active in promoting sales of coal-burning equipment shortly before 1955.

There are obvious problems to be solved in the setting up of such an organization—but in addition to increasing coal's acceptance it would accomplish a greater degree of integration toward the point of use and thus provide an additional source of income.

Cooperative Action—The pattern for cooperative action is largely set, though many of the details are yet to be worked out. Coal management's job is to strengthen the ties and work for the maximum in coordination—as, for example, between the market promotion departments of the United Mine Workers of America and the National Coal Association.

Sales Promotion—Here is a job for individual companies as such and for the industry as a whole. A great deal of very good work has been done in recent years, but the job of getting architects, consulting engineers, builders, plant owners and opperators—in fact all people who have any influence, direct or indirect, on the type of fuel purchased—fully acquainted with what coal has to offer is a tremendous one. A lot more in advertising and all other forms of promotional work can be done in full assurance that it will pay off.

Sales Skill—It is a fact that the average coal salesman today is far more skilled than his immediate predecessor. This reflects, among other things, the growing appreciation of the value of skill in selling, as well as the growth in size not only of producing companies who do their own selling, but also of independent sales agencies. This growth provides sufficient strength to make possible the creation of skilled men in sufficient numbers to be effective.

Every addition to the ranks will help. This is primarily a job for individual producers and sales agents.

Consumer Service—The records made by the Marketing Dept. of NCA and its predecessors, as well as the service organizations of many individual companies, are the best evidence of the value of well-trained and knowledgeable service men. There is no substitute in battling competition when it is bidding for a new job or trying to muscle in on an existing customer. Likewise, there is no substitute when trouble arises or questions come up.

Continued strengthening of both the industry organizations and the organizations of individual companies is an obvious way of getting the jump on competition for new business, and insuring that old customers remain satisfied and in no mood to change.

Public Relations For Coal Progress

THOUGH IT MAY NOT APPEAR SO at times, coal's standing in the eyes of the public, law-making bodies and administrative agencies is so much higher than it was, say, 25 yr ago that there is almost no comparison. This is a reflection of a number of things. For example, the hard work, outlays for equipment to cut cost and heighten quality, and the development of a firm attitude toward giving mining properties away in the form of price cuts have put the bituminous industry definitely into the black—even in the present depression period. The resulting high regard of the financial and investment community is an asset almost priceless in its real value. Then also, the attainment of a basis of cooperative action with the United Mine Workers of America stands as another asset also almost priceless in nature.

Industries where management and men are constantly at each other's throats are likely to be regarded with a jaundiced eye by the public and public and law-making bodies. Contrariwise, cooperation with the good of the general public as its visible and unmistakable goal always generates respect and greater receptivity for the story the industry has to tell and the principles it stands for.

Organizing for Progress

If the preceding were all the industry still would be greatly ahead from the standpoint of public and governmental relations, though short of its present high status. The difference represents a definite and systematic attempt to take coal's story to all people in both private and public life, using all possible media.

The year 1942 perhaps is the significant date. In that year the bituminous industry set up the Bituminous Coal Institute. It soon proved that it could do the job it was set up to perform, with the result that it became one of the arms of National Coal Association.

Parallel work by the anthracite producers on an informal basis also led in a relatively short span of time to the organization of facilities leading to the present Anthracite Information Bureau.

But the standing of coal, and in turn its progress in the market place, is of interest to more than coal men themselves—the UMW, for example, railroads, coal distributors, manufacturers of mining and burning equipment, even utilities serving predominately mining areas, and others. To enable them to add their weight to the organized effort, it was felt that another and broader organization was necessary.

This feeling resulted in the formation of the National Coal Policy Conference in 1959. Even though it has been in existence only 2 yr or so its record of accomplishment is an impressive one.

The final ingredient in coal's standing with the public today represents the efforts of the individual coal companies themselves, plus those of individual companies in allied industries. As with the organized effort, the total effort is the sum of many individual actions. One evidence of the progress made by individual companies is the significant and growing number that employ public-relations officers and staffs to make sure that the job is done in the way that will yield the maximum in benefits.

Tomorrow's "Image"

"Image creation" is now a popular term for public-relations programs.

In this connection it might be noted that this is a misconception in many instances, of which an outstanding one is coal. The problem in coal is not to create an image, though no one questions that improvements in certain areas can be made. Rather, the job is to clear away the fog of misunderstanding and keep it cleared away so that the public and its representatives see coal for what it is—a progressive industry that expects to make more progress, including bringing any lagging facets up to the recognized standard of excellence. The goal is attaining a public and governmental respect and confidence that will result in coal's good faith always being assumed, and its representations as to legislation and otherwise always being given full weight by lawmakers and administrative bodies.

Utopia need not be expected. But eradication of misunderstanding and hostility should be a No. 1 activity. There is plenty still, as those who represent the Speakers' Bureau of the National Coal Association can vouch. Since the average American is at one time or another a tourist and is almost sure to go through stripping country, a speaker is practically always tackled about "tearing up the land," sometimes phrased as "ruining the country." When the facts on reclamation are presented the improvement in the questioner's attitude, and in that of his fellow listeners, is prompt and unmistakable.

Not everything can be cleared up as quickly and easily, but a few things are obvious. A young representative in Congress from a noncoal state who in school used a textbook that pictured coal as a backward industry of hard hand work, low wages and almost sure injury or death, is likely to be harder to convince that a measure urged by coal should receive his earnest consideration.

Building Stature

One outstanding thing about a good public-relations program is that it works—always provided, of course, that the job the industry is doing to serve the public and be a responsible member of the body public is a good one. A second is that you can't let up. For public relations to be effective it must be carried on continuously year after year. It cannot be turned on and off like a faucet.

This conclusion, however, need not be a dismaying one. There is a continuing cost but it is not exorbitant and is returned several times over. But a lot of the activity that generates good public relations costs nothing in money and not much more in time and effort—a letter to a newspaper or a speech to a Rotary Club, for example.

The individual, the company and the industry all are involved in public relations and its blood relative, government relations. Some of the key activities include the following:

By the Individual . . .

Cooperation in industry programs where provision is made for such cooperation and it is solicited by the industry organization. Participation in the program of the Speakers' Bureau of the National Coal Association is an example of such personal cooperation. Calling on congressmen and senators, members of state legislatures and other public officials or elected representatives—or writing them when the occasion presents or the request goes out—is another.

Participation in community affairs. Perhaps one need not seek for civic jobs and responsibilities, though there is nothing wrong with this idea. But the coal man should be seen and heard, and if he is chosen, for example, a member of the school board or some other local body, his coal connection of course becomes known. The net result should be a boost for the industry.

Commenting on current questions and problems in, for example, meetings of public officials, letters to local newspapers and appearances on the local radio or TV station.

And so on.

By the Company . . .

First, perhaps, the company can build up coal's stature by being a good employer. This doesn't mean babying men or giving in to their whims, but instead of conscientious effort to be fair and friendly in relations with men even while being firm; also providing good working conditions, and wash-and-change and other facilities.

Second, the company can be a good neighbor by making sure it creates no nuisance, such as a smoking gob pile, and that its premises present a pleasing appearance—painted, landscaped, clean and well-maintained.

Third, the company can be hospitable and in fact it should plan for and encourage the visits of people both from the home community and far places. Special events, such as a childrens' day, open house for employee families and friends, and similar steps get the company known—and in a favorable light.

Fourth, the company can keep the community posted on what is going on with it and its employees—and with this it can earn respect and goodwill by giving prompt and complete replies to questions.

Fifth, the company can support and participate in community activities and projects—Homecoming Day, for example, fund drives, Girl and Boy Scout programs and others.

Sixth, the individual coal company can make sure to keep congressmen, senators, legislators and public officials acquainted with its and the industry's views on matters of concern to coal and the general public.

And, along with these and other steps, the company can support the organizations responsible for the industry campaigns which cover the Nation.

By the Industry . . .

Basic, of course, is getting coal's story to the major news mediums and the legislative and policy-making executive officials in government—state, federal and local, as well as such opinion-molders as editors, ministers, educators and so on; text and general book authors, civic organizations of all kinds wherever situated, and all other persons or organizations whose ideas and opinions are likely to be respected and accepted. All possible mediums must be employed to the maximum extent practicable—from advertisements in national publications to lining up a speaker for a service-club luncheon attended by only 20 or 30 people—but people who usually are among the leaders in the community.

The industry job has been a good one. It can be a better one with more support in the form of more funds and more participation by individuals and companies within and without the industry.

Coal Today . . . As the UMW Sees It

Chase Ltd. Photo

By **Thomas Kennedy,** President
United Mine Workers of America

THE FUTURE of the coal industry is tied to the future of the Nation. For America will eventually need every precious bit of energy that is buried within every lump of coal. The coal industry needs the best that is in the institutions of free enterprise and political democracy if it is to survive to fulfill its destinies.

Coal has a long and proud history in America. The Nation was brought from a virgin wilderness to a vast industrial complex because coal existed in abundance. The civilization that is present in America today presupposes vast coal reserves and the technical and human skill necessary to mine such reserves.

The coal miner has shared in the formation of the American tradition. The great demands that coal mining imposes call for a special breed of man—a man who would and will stand firm before the onslaught of cruel Nature. In every coal camp in this nation the men who went into the mines faced the harshest of all industries and yet supplied America with enough energy to emerge as the strongest industrial nation in all the world.

Indeed, the coal industry and the coal miner can be proud of their past accomplishments. But the eyes of the coal industry and the coal miner are fixed on future accomplishments, rather than on past glory.

The United Mine Workers of America, which represents the coal miners of this Nation, believes deeply that the coal industry has a glowing future. So firm is the faith of this union in that future that it has embarked upon programs and policies unheard of in the annals of labor unions. This organization has in recent years approached the traditional concepts of collective bargaining and labor relations with its prime aim, of course, to better the lot of the American coal miner, but also with the new view of making that coal miner and his product more valuable to the public.

It must always be recognized that the consumer is the final factor in determining the success or failure of an industry. Free enterprise has rich rewards for the industry which can supply a product that is needed by the public. Any labor union which is able to enhance the value of the product to be sold can also reap rich rewards for its membership and assure that membership of a valued place in the industrial future of this nation.

Coal has much to offer this country. Its reserves constitute the largest single block of fossil fuel available on this continent. According to knowledgeable experts there is sufficient coal to supply America with abundant supplies for over a thousand years.

The coal industry has led the way in the national trend toward more efficiency in productive techniques. In fact, since 1950 the average output per day of the soft coal miner has jumped from 6.77 tons to 12.83 tons. This improvement in productivity was made possible by a complete revolution in production techniques and increased efficiency of miners. Machines have replaced the pick and shovel of bygone years.

It has long been the position of the UMWA, in fact, since 1900, that the only way to secure better wages and conditions was through increased productivity. There has never been any hint of featherbedding in coal, because the coal miner has always been willing to return a fair day's work for a fair day's pay.

The price of coal, because of the increase in output per man per day, has remained steady during the past decade. This is a tribute to the vision of the coal operators who spent millions of dollars to modernize their facilities and the coal miners who realized that their future security rested with the ability of the coal industry to keep costs at the lowest possible level.

There have been no major strikes in the coal industry for the past eleven years. The contracts that have been negotiated since that time have reflected the mature attitude of both the operators and the union in realizing that the overriding responsibility of both parties is to seek the common good, aside from the usual bargaining over specific provisions of the contract.

The coal miner is among the most highly paid industrial workers in the world. The coal miner also has a Welfare and Retirement Fund which provides, among other things, a pension plan and complete hospital and medical care for the coal miner and his family. All of this has been accomplished by the coal miner and his union without raising the price of coal. So the modern coal industry and its labor force stand ready to meet the needs of a growing America.

Already one industry has recognized the many advantages of using coal. This is the electric utility industry, which last year consumed 176,500,000 tons of coal. The utility market is the fastest growing of all the potential markets for coal and if all indications are correct there is literally no end to the expansion that can come to coal in the area of electric generation.

The utilities see in the coal industry a stable, reliable source of fuel. They are also aware of the anti-inflationary nature of the coal industry and the advantages of such an industry to another industry as closely regulated as the electric utility industry. The success of the

coal industry's efforts to woo utility business has resulted in the erection of coal-fired steam plants in such unlikely places as Arizona, New Mexico and even Florida.

The increasing utilization of coal by the electric utilities presented an opportunity for the industry to recapture a large portion of the home heating market now largely lost to coal. The UMW engaged in a concerted campaign in the *UMW Journal* to sell the advantages of "coal by wire" to the American public. The logic behind this promotion is simple when it is remembered that every electrically heated home will consume between 8 and 11 tons of coal—"by wire"—each year. Further, this coal will be burned at the utility plant and consumed in the home in the most modern form available to the consumer, thus adding to the employment opportunities of the coal miners.

Because of the stepped-up promotional effort and the narrowing of the price differential between electricity and gas and oil, over 1 million homes are now heated electrically. The next decade should see an acceleration of the trend toward electrically heated homes and the time of the dominance of all-electric living is not far off.

But the coal industry can look to even broader horizons than that of the electric utility market. The limits of coal's future can only be delineated by the willingness of the leaders of that industry to grasp the enormous potential that is present in the American economy. Basic to the future of coal, however, is a research program that will unlock the many treasures that lie hidden in each lump of coal.

The United Mine Workers of America has for many years done everything possible to encourage maximum research efforts on coal by public agencies and private groups. In our opinion the genius of the American scientist must somehow be linked to the acknowledged genius of the American coal industry and its employees in their productive effort if a stable industry is to be fashioned.

In our efforts to stimulate research activities on coal, the UMWA has cooperated with every group interested in this end. The UMWA was in the forefront of the fight to secure the passage of a Coal Research Law by Congress. Representatives of the UMWA are presently serving on the General Technical Advisory Committee of the Office of Coal Research, which was established within the Department of the Interior, Public Law 86-599. These officials submitted to the first meeting of the Advisory Committee a resume of research activities that could have great effect upon the production and sales of both anthracite and bituminous.

Besides the activities on a governmental level, The Research and Marketing Department of the United Mine Workers of America is specifically charged with the responsibility of facilitating research efforts that will be beneficial to the coal industry and thus, to the UMWA membership.

Happily, the awareness of the potential of coal research is becoming known to the responsible officials in the industry. Many companies are undertaking or are planning to undertake research activities in coal. Bituminous Coal Research, Inc., the agency of the industry directly responsible for research projects concerning coal, will soon move into new headquarters near Pittsburgh, Pa. From there BCR can carry on both applied and basic research.

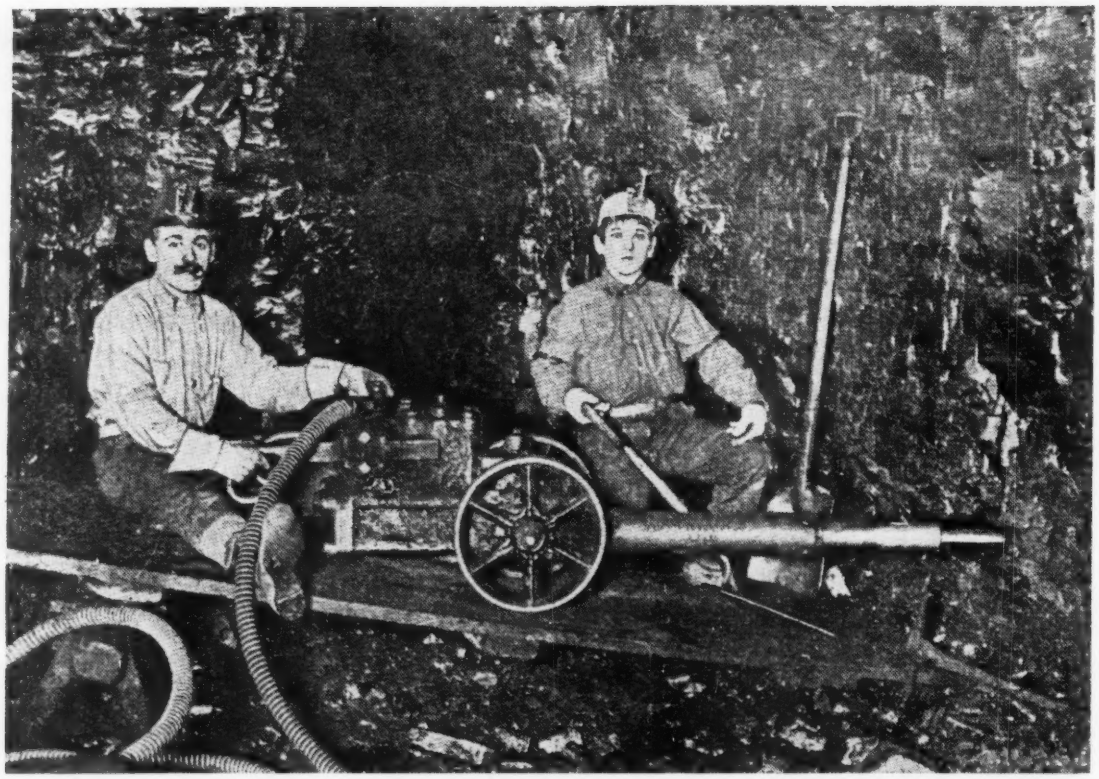
Coal can share in the success of the research-oriented companies if only it accepts the economic facts of modern life. The success of the oil industry in the petro-chemical field should be adequate warning that our competitors realize the value of research to their continued economic survival. The lesson we learned from the dieselization of the railroads and the other advances made by other fuels in serving the needs of America, should highlight the need for the coal industry to enter this research struggle to remain competitive in supplying America with the goods that it has come to expect from industry.

Many of the readers of Coal Age are familiar with the National Coal Policy Conference. But to those who are not, the unique character of the Conference should be a pleasant surprise. For in NCPC all of the forces interested in the welfare of bituminous coal have come together to promote such welfare. The UMWA, through the leadership of President Emeritus John L. Lewis, suggested the idea for the National Coal Policy Conference. The union is represented on the Board of this organization by President Emeritus John L. Lewis, President Thomas Kennedy, Vice President W. A. Boyle, and Michael F. Widman, Jr., Director of the Research and Marketing Department. These men, in conjunction with representatives of the other industries involved in NCPC, bring their talents and the prestige of their organizations to fight for the cause of bituminous coal in which all have a vital stake.

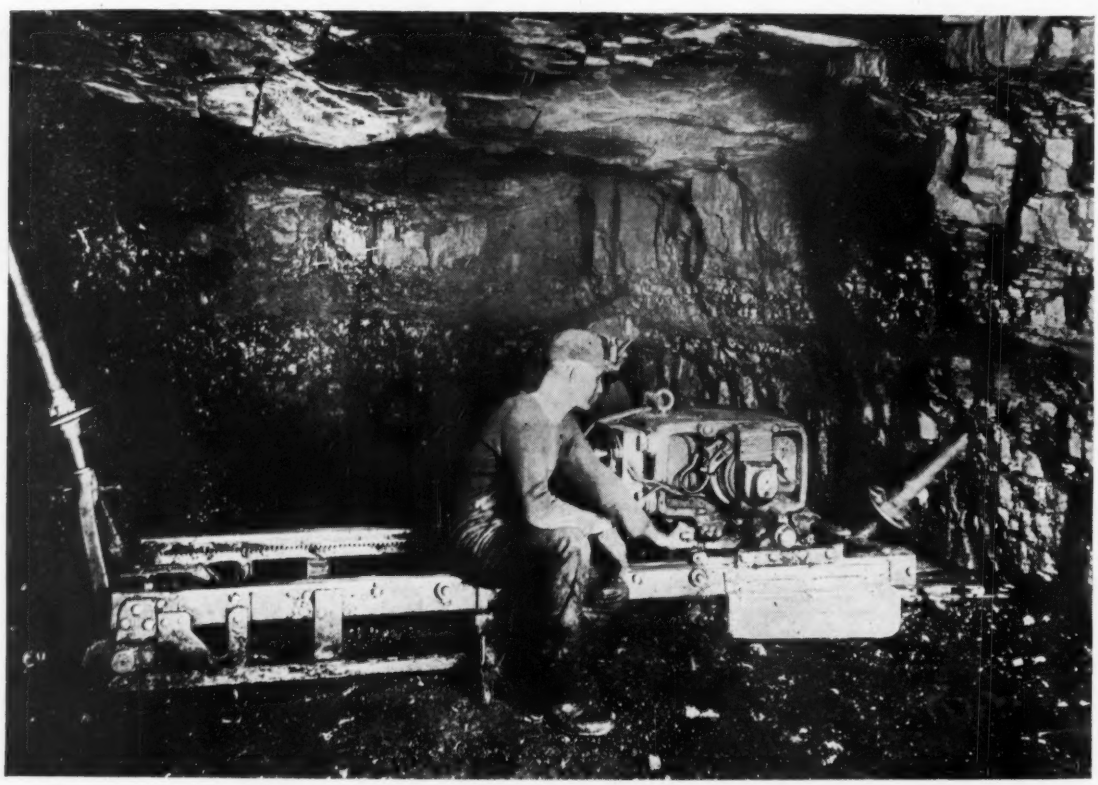
In addition, the UMWA is working closely with the other organizations which protect and promote the interests of coal. Among these groups are the National Coal Association, representing the soft coal operators, and the Anthracite Institute, representing the anthracite industry. Very often problems arise which can be most effectively solved by close liaison between the operators and the union. Such occurrences, for example conversions of military installations to rival fuels, are becoming increasingly common in the highly competitive energy field. When the labor and management groups join forces to fight in the interest of coal, they present a formidable picture. Very often tonnage which would otherwise be lost is retained and new business is attracted to coal.

In coal there is a rejuvenation, a desire of all segments of the industry to again assume a role of importance in the American economic life. New men with new ideas are assuming roles of importance in coal circles. The industry is no longer content to accept the scraps that the other sectors of the fuels industry are willing to throw to coal.

This is why the UMWA feels confident that the future of the coal industry is secure. The thousands of years of coal reserves, added to the skill of the coal miners, added to the advancing technology of the coal operators, added to the need of America for such an abundant supply of fuel, added to the determination of all segments of coal to sell the advantages of coal to the nation, is certain to bring on another era in which coal is truly King.



PRE-1910 FACE MACHINES were limited almost completely to cutters for reducing the arduousness of the miner's task and improving safety and promoting lump yield in shooting. First machine to achieve wide use in the U. S. was the compressed-air puncher, which gave way to the chain breast machine, both yielding, starting about 1910, to the shortwall.



The Early Years... In Deep Mining

FORTY YEARS of the past half century in coal were spent in merely doubling tons per man-shift in bituminous and raising it only some 30% in anthracite. Then both industries began to go, and both doubled their 1950 figures in the 10 yr to 1960. Another doubling by 1970 perhaps is not in the cards, but a further rise of 50% or better already is in the making.

The takeoff point in the year 1950 in both industries is plainly evident on the chart on the next spread of pages in this issue (158-159). In 1950, in bituminous, stripping had grown to where it was accounting for 23.9% of the output. Underground, mechanical mining had advanced to the point where it was responsible for 69% of the deep tonnage. In 1960 the strip percentage had moved up to 29.5, while underground 85% of the output was handled mechanically, with nearly 78 million tons from continuous miners, compared to practically zero in 1950.

In anthracite, stripping accounted for 26.9% of the total output in 1950, while 43.8% of the deep tonnage was produced mechanically. In 1960 the strip percentage had increased to 37.8, and the percentage of underground tonnage mechanically produced to 52.6.

The Pre-1910 Years In Cutting Machines

Though progress was slow in the 1910-50 period, and the hand loader was king for a good part of the time, it was not for lack of interest in something better. The hard physical labor and the low productivity of the man working with only a pick and a shovel had been of concern almost from the beginning of the industry. Explosives, for example, were used to ease the miner's job in the Royal mines, Schemnitz, Hungary, as early as 1627, and in the U.S. in the Smith Bros. mine, Plymouth, Pa., as early as 1818.

Machines go back to the 1700s. Michael Menzies, an Englishman, tackled the problem of developing a mechanical coal cutter in 1761. He proposed to drive his cutter by reach rods from a steam engine on the surface. Around 1850, compressed air was introduced in the Govan Colliery, Glasgow, and was followed by development of a number of machines relying on it. The first really practical of the early machines was the "Iron Man," by Firth, of Leeds. The first chain-type machine ("Gartsherrie") was installed in Lochwood pit, in Scotland, in 1864, and is regarded as the ancestor of all the chain machines since.

Key developments in coal cutting in the U.S. prior to 1910 included the following:

1877 — Harrison compressed-air puncher; Jeffrey (Lechner) revolving-bar breast machine.

1890—Electrically driven chain-type longwall cutter developed by Elmer A. Sperry who, with his brother-in-law, H. E. Goodman, formed the Sperry Electric Mining Machine Co., later the Goodman Mfg. Co. Earlier, Mr. Sperry had tried to electrify the puncher.

1894—Breast machines developed to commercial stage.

1897—Sullivan air-operated short wall installed at Moon Run, Pa. An electric machine followed in 1898, and other manufacturers brought out similar machines in the next 10 yr or so. Thus, in 1910, 47 shortwalls were in service, compared to 6,716 punchers, 5,973 chain breast machines and 518 longwall units.

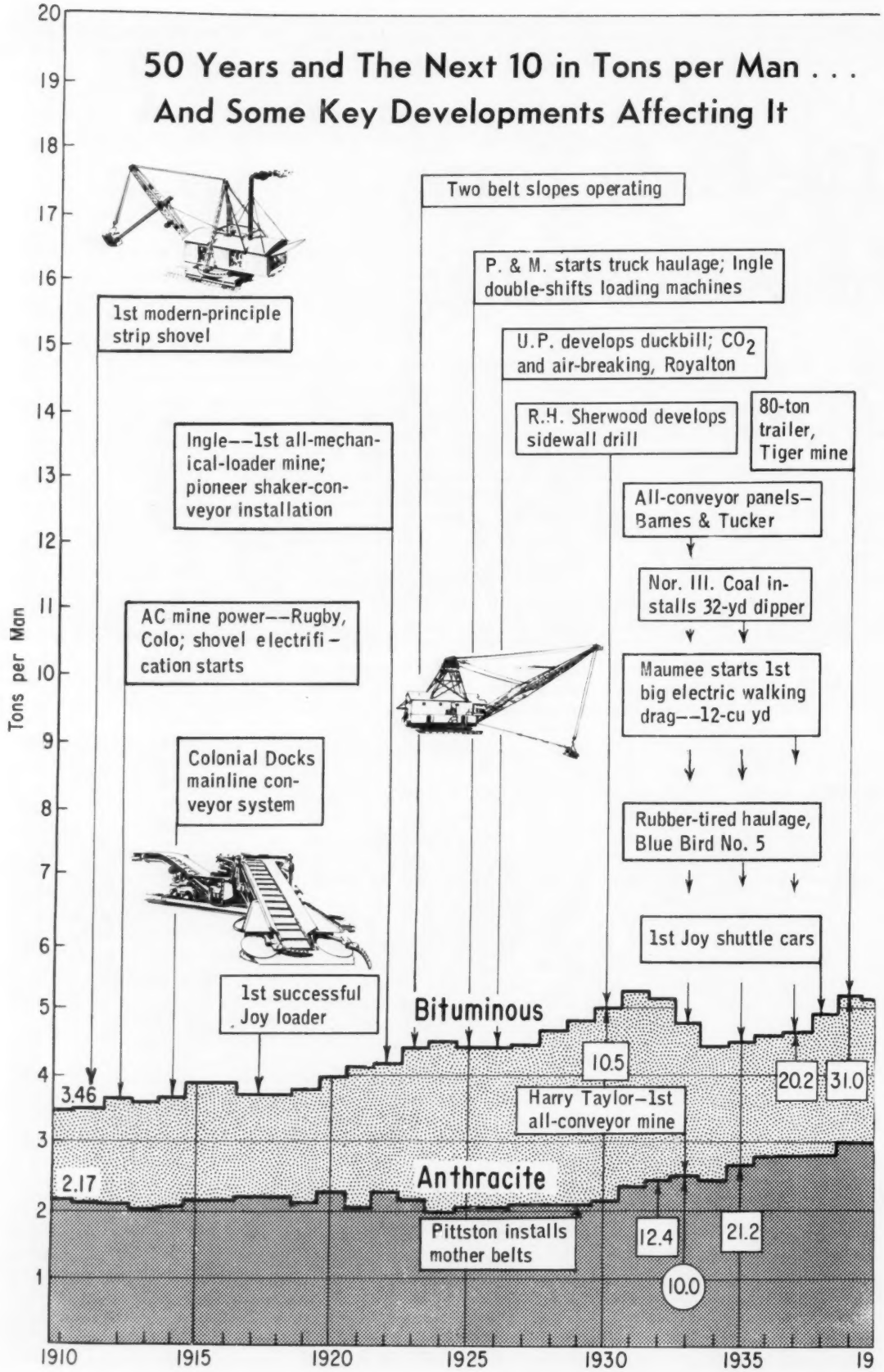
Loading Machines In the '90s

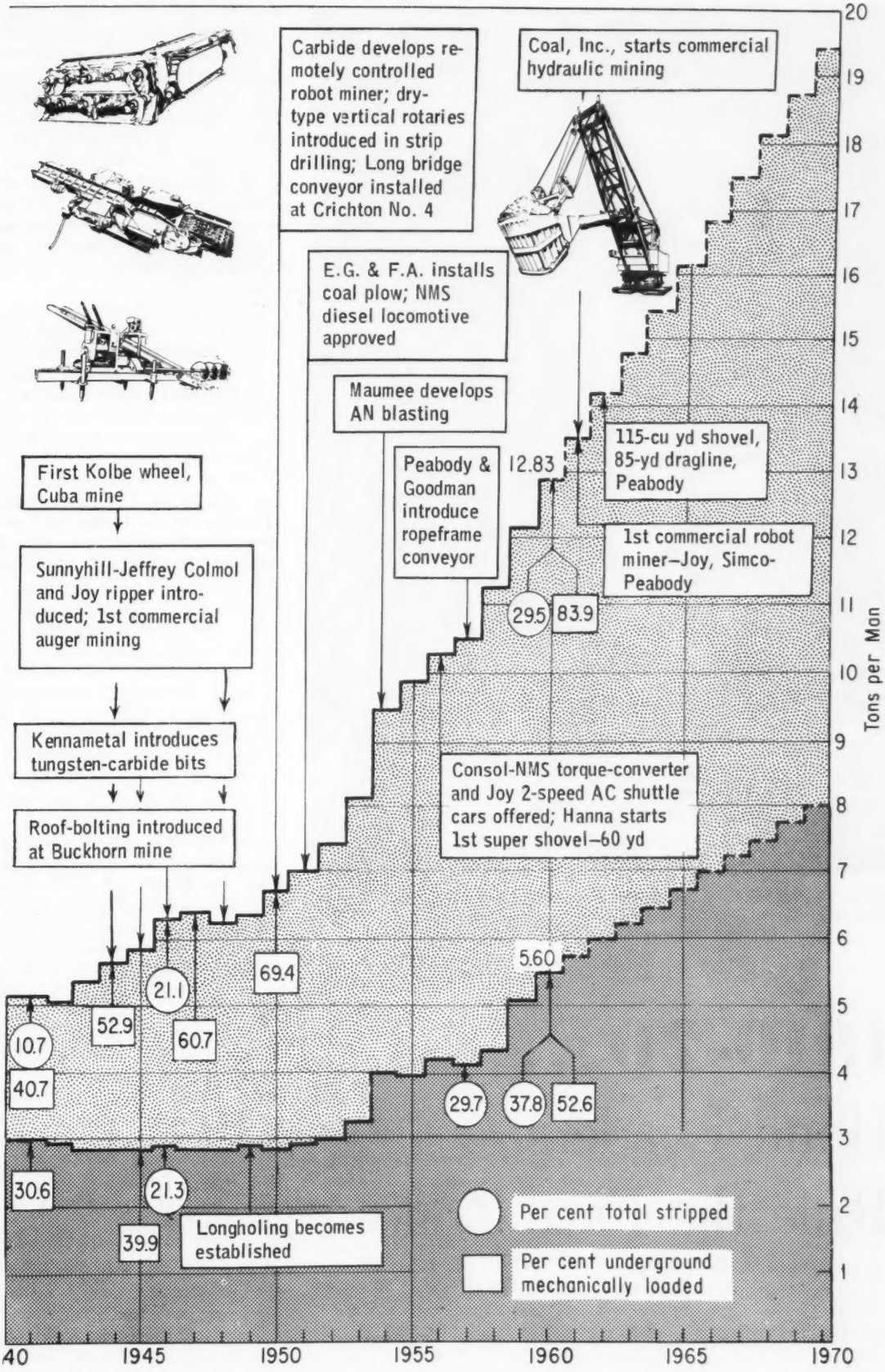
Though the cutting machine eliminated the exhausting physical labor of undercutting with a pick to provide another free face and thus enhance the yield of high-priced lump and improve safety in shooting, loading was still the job of the man with the scoop up to 1910 and for many years afterward. Again, this was not for lack of interest in machines to substitute for muscle. As early as 1888, in fact, one U.S. operator attempted to go the whole way to mining of the present continuous type, skipping the cutting, drilling and shooting steps. He imparted a Stanley header, the ancestor of today's boring-type units, into the Franceville mine, Colorado Springs, Colo. In 1890, a Stanley header with conveyor went into the Bennett mine, Lebanon, Ill. But shafts, gearing and other components—and particularly bits—couldn't take it, and it was to be several decades before advances in metallurgy would beef them up to match the job.

Several loading machines were dreamed up between 1893, when work leading to the building of the Jones (Coloder) series of machines got under way, and 1910. The O'Toole mining and loading machine —another attempt to go all the way —was tried in the Leisenring No. 3 mine of the H. C. Frick Coke Co. in 1896.

In 1902 conveyors were first installed on longwall faces by Clarence R. Claghorn at Vintondale, Pa. The St. Louis & Big Muddy Coal Co., Dewmaine, Ill., got a Hamilton loader in 1903, and in 1908 the first Myers-Whaley machine went into the mine of the Windrock (Tenn.) Coal & Coke Co.

By 1910, therefore, the machine idea was being actively pursued, though with indifferent results then and for quite a few years later, as outlined in subsequent pages in this study of mining developments and what lies ahead in the future.


50 Years and The Next 10 in Tons per Man . . .
And Some Key Developments Affecting It
Tons per Man
1st modern-principle strip shovel
Two belt slopes operating
P. & M. starts truck haulage; Ingle double-shifts loading machines
U.P. develops duckbill; CO_2 and air-breaking, Royalton
R.H. Sherwood develops sidewall drill
80-ton trailer, Tiger mine
Ingle--1st all-mechanical-loader mine; pioneer shaker-conveyor installation
All-conveyor panels--Barnes & Tucker
Nor. Ill. Coal installs 32-yd dipper
AC mine power--Rugby, Colo; shovel electrification starts
Maumee starts 1st big electric walking drag--12-cu yd
Colonial Docks mainline conveyor system
Rubber-tired haulage, Blue Bird No. 5
1st Joy shuttle cars
1st successful Joy loader
Bituminous
3.46
10.5
20.2
31.0
Harry Taylor--1st all-conveyor mine
2.17
Anthracite
Pittston installs mother belts
12.4
21.2
10.0
1910
1915
1920
1925
1930
1935
19


Carbide develops remotely controlled robot miner; dry-type vertical rotaries introduced in strip drilling; Long bridge conveyor installed at Crichton No. 4
Coal, Inc., starts commercial hydraulic mining
E.G. & F.A. installs coal plow; NMS diesel locomotive approved
Maumee develops AN blasting
Peabody & Goodman introduce ropeframe conveyor
115-cu yd shovel, 85-yd dragline, Peabody
1st commercial robot miner—Joy, Simco-Peabody
First Kolbe wheel, Cuba mine
Sunnyhill-Jeffrey Colmol and Joy ripper introduced; 1st commercial auger mining
Kennametal introduces tungsten-carbide bits
Roof-bolting introduced at Buckhorn mine
Consol-NMS torque-converter and Joy 2-speed AC shuttle cars offered; Hanna starts 1st super shovel—60 yd
Longholing becomes established
Per cent total stripped
Per cent underground mechanically loaded
Tons per Man
12.83
29.5
83.9
69.4
21.1
10.7
52.9
60.7
40.7
5.60
29.7
37.8
52.6
30.6
21.3
39.9
20
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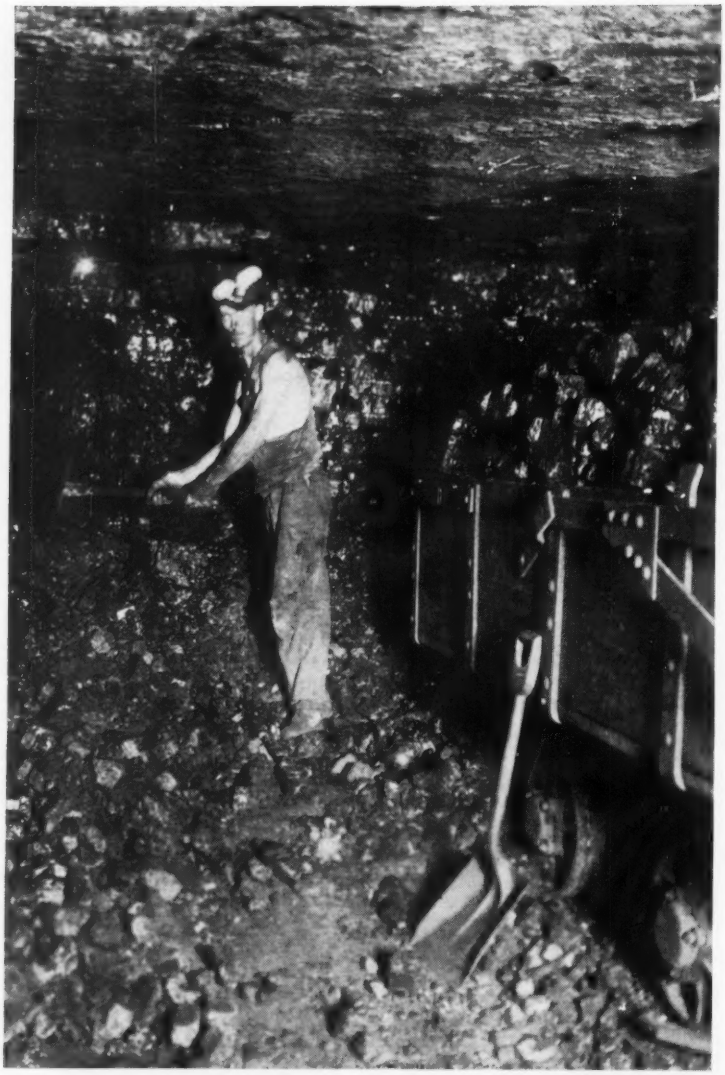


COAL TRADEMARKS in the 1910-20 era were the pick and the shovel. Interest in loading and mining-and-loading machines was keen but none rose to challenge the hand loader until near the end of the decade.

1910-20...
Hand Loaders Rule the Face Zone

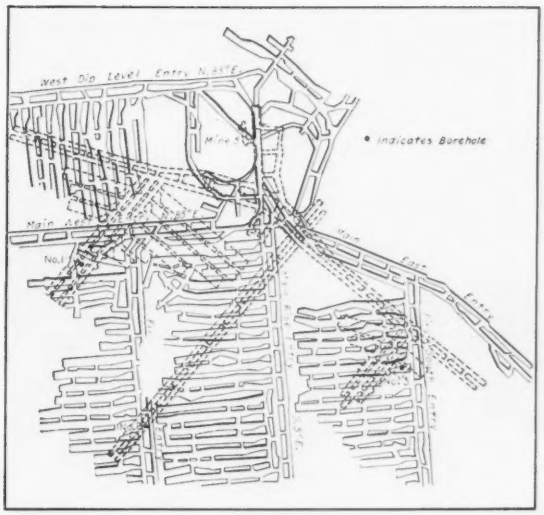
BETWEEN 1911 and 1920 at least 12 types of loading machines were tried out in the bituminous industry, in addition to scrapers in bituminous and anthracite. The list? Jackson, Jeffrey 32-A and 37-A, Halby, Westmoreland, Kuhn, Billings, Joy, Oldroyd, Dillig, Crawford-London and Hunt. The first of the pit-car loaders, once used in hundreds but now almost forgotten, also went into anthracite in 1916. And one company installed electric shovels underground in thick coal.

Mining-and-loading machines, equivalent to today's continuous miners, also were developed in some numbers — Ingersoll-Rand heading machine, Jeffrey 34-B entry-driver and 39-A miner, Powell mining-and-loading machine and the McKinlay entry-driver.

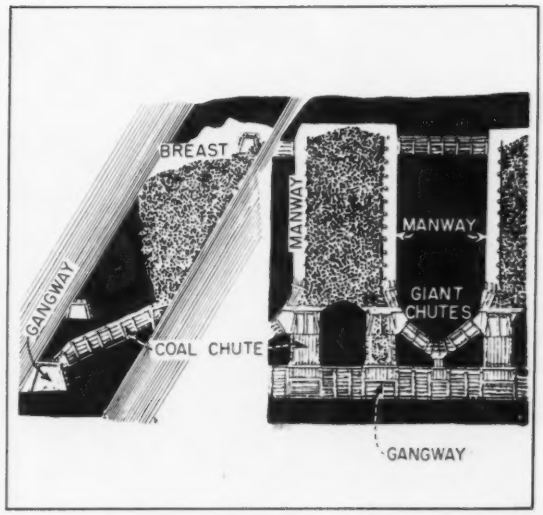
Two of these units survived and now are serving in modern form. One was the Joy loader, tried out first in 1916 in the Somers No. 2 mine of the Pittsburgh Coal Co. This mine also got the first successful unit in 1917. The McKinlay gave rise to what is now the Marietta, and in turn owed its principle of operation to the Stanley header of 1888. It found its first application in the mine of the Southern Coal, Coke & Mining Co., Belleville, Ill., in 1920.

But in spite of all this activity the 1910-20 decade was a decade of 100% hand-loading—the last such in the history of the bituminous industry. The shortwall displaced the punchers and breast machines almost completely, and power drills were introduced and used in increasing numbers. However, the significant advances in face preparation in this era revolved around the development of, first, the track-mounted top or bottom cutter, soon offered with an adjustable-height bar for cutting at various levels, and ultimately the universal machine. The Jeffrey track-mounted cutter, development of which started in 1908, was put on the market in 1911. The Goodman "straight-face" top and center cutter followed in 1914, and the Oldroyd—the first of the universal cutting and shearing machines in 1916.

Room-and-pillar then, as now, was the predominate mining system. However, there was a fair amount of circular longwalling—both advancing and retreating—in northern

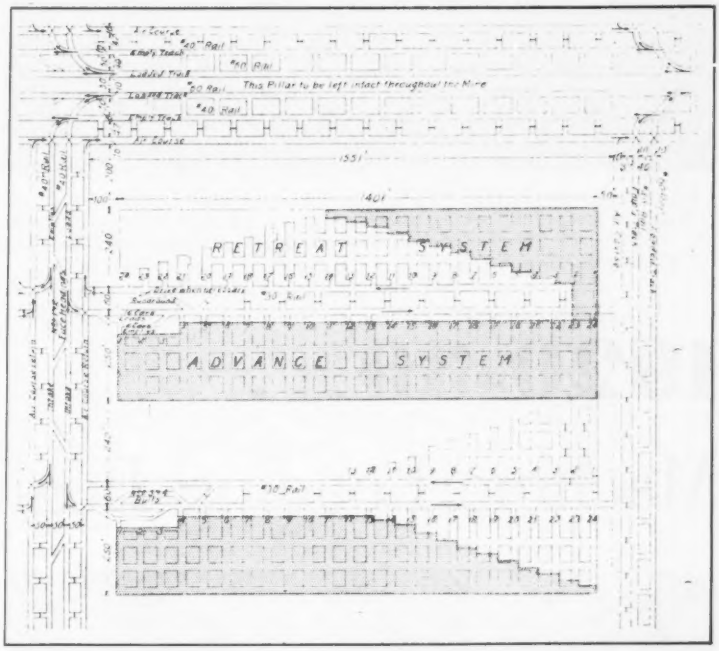


TYPICAL MINE WORKINGS in bituminous in the early days were not notable for regularity.



BREASTS STRAIGHT UP the pitch were the backbone of anthracite mining in the 1910-20 decade.

EARLY PANEL PLAN featuring advance and retreat, regularity in development and complete extraction. The long angled pillar line was typical of practice in those days.

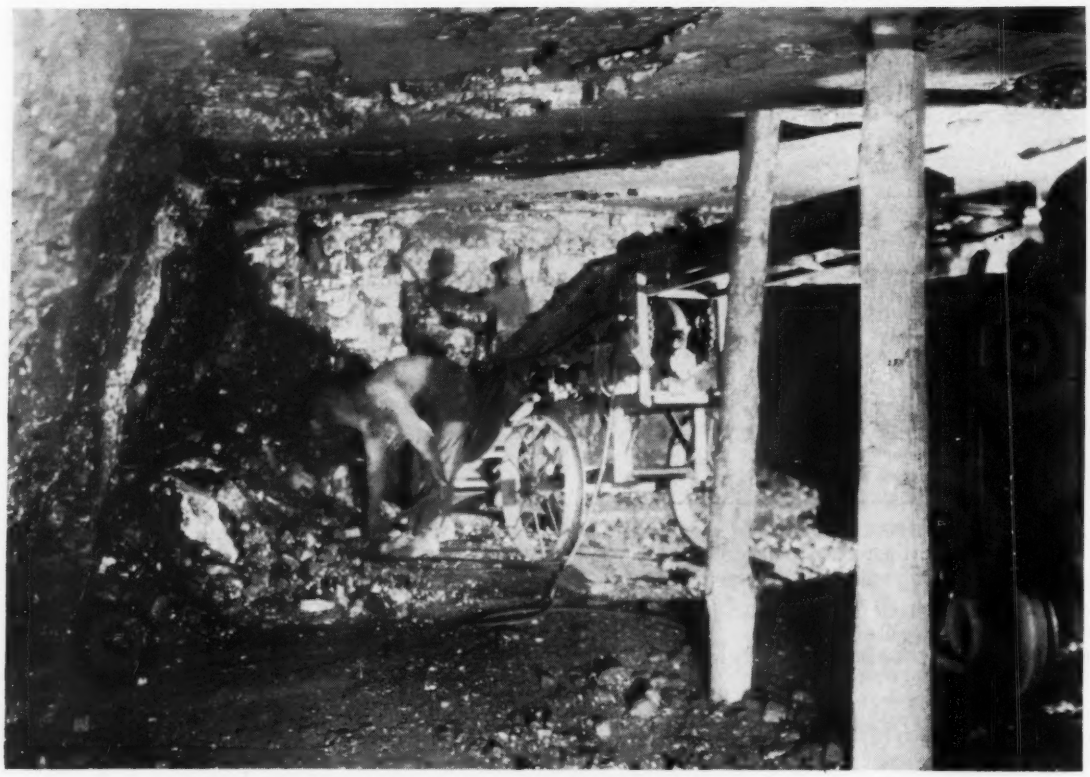


Illinois, Iowa and the southwestern states. Then, as now, room-and pillar offered the advantages of simplicity, ease of roof control and ventilation, and flexibility.

Attempts were being made even in those days to achieve regularity and concentration in mining, witness one of the 1910 plans reproduced herewith. It involved advance on one side and retreat on the opposite in panels. The long pillar lines are characteristic of the period. At some properties, they were extended across several entries. The angle was almost always 45 deg, which then was thought to be essential in achieving the best in roof control. Every place was, of course, laid with track so that mine cars could be brought in.

Usually, however, extraction was much more a haphazard matter, and more mines than not tended to look like that in a second illustration herewith. Not only was development on the ragged side, but pillars were left more often than taken. In fact, some owners went out of their way to cause themselves trouble by starting to mine immediately after breaking away from the shaft bottom or portal and leaving the pillars for extraction at a later time. The loss in pillars was, of course, tremendous, in addition to the damage to main openings and the like resulting from squeezing—an all-too-common accompaniment of this method of attack.

Breast-and-pillar was the anthracite equivalent of room-and-pillar. In the 1910-20 period the practice still was to drive the water-level gangways in the coal, as shown in an accompanying plan, and then advance straight up the pitch. As in bituminous the tendency was to mine on the advance. Consequently, gangway trouble was common. Even when retreat mining was done retimbering was a major item. As a result there was a trend even in those days toward development in the rock under the vein to achieve a stable, maintenance-free main opening.



A PHENOMENON OF THE 20S, the pit-car loader (above) soared in 5 yr to an output of over 19,000,000 tons, then began to decline in favor of the loading machine (opposite page), which began to demonstrate its capabilities. The mine car behind the machine was typical of practice until the late 30s and 40s.

1920-30...

Machine Loading Begins

A NEW ADDITION to the ranks of loading machines in the 20s was the shaker conveyor, made into a loader by the invention of the duckbill.

IN 1921 COAL handled mechanically probably was less than 500,000 tons in the bituminous industry; likewise in anthracite. By 1930 the bituminous total had risen to 46,982,000 tons; anthracite to 4,468,000 tons.

Of the 1930 bituminous total, 19,116,000 tons was handled by a type of machine now almost forgotten—the pit-car loader. Its rise was swift. In 1926, the first year for which data on output are available, pit-car-loader production was 523,000 tons. The peak was 19,172,000 tons in 1931. The ensuing decline brought the tonnage handled by these machines down to less than 40,000 in 1950.

A sales price of $500 to $1,500

for most of the units, plus the fact that they did enable hand loaders to raise their output, were the big reasons for the rush to the pit-car loader. They were soon recognized to be only a stopgap, however, and consequently their rejection as the ultimate solution was inevitable. The loading machine, though more costly, really raised the tons per man. As a result, loaders handled 20,073,000 tons of bituminous in 1930 and were firmly established as the machine of the long-run future.

A look at the record shows that three-fourths of the mechanically handled bituminous tonnage in 1930 came from five states: Illinois (almost half), Indiana, Wyoming, Utah and Montana. There was a reason. After the operators in the East rebelled against the Jacksonville agreement of 1924, the remaining UMW membership was largely in these states, which had to compete against lower wages elsewhere. Consequently they went to machines to get their cost down—the first example of the role played by wage rates in promoting the use of machines. The years since have witnessed additional emphasis on machine use with each increase in the wage scale.

Another large group of machines was offered in the 1920-30 period, continuing the pattern of 1910-20. They included the American, Brown electric shovel, Corrigan, Auto-Moto, Conway rock loader, Shuveloader (rock), Peale loader, Wilson Chainloader, Buffom, Holmsted, Mason, Jeffrey 42-A, O'Toole cutting-and-loading machine, Goodman power shovel, Ingersoll mining-and-loading machine, Stockly, Hoar shovel, Jeffrey Shortwaloader, Mullen conveying-and-loading machine, McEachen, Sullivan, Riley, Whammond, Whaley single-motion, Shanaberger, Covington, Whaley Automat, Jeffrey 44-C and Clarkson, in addition to the Joy 5BU and other Joy models. Joy's lead in number of machines was firmly established in this period.

Development of both big and small scrapers continued, and both shaker and chain conveyors made headway. A key development in the conveyor field occurred in 1926, when Union Pacific developed the "Duckbill," converting the shaker conveyor into a loading as well as a conveying machine. The duckbill was taken over by Goodman in 1931, and was instrumental in getting shakers widely accepted and used.

Perhaps the best evidence that the machine was really on its way was the opening of the first all-mechanical mine, using Joy machines, by David Ingle Sr., at Oakland City, Ind., in 1922. Earlier, in 1920, the Pike County Coal Corp., Peterburg, Ind., had signed the first mechanical loading wage agreement, covering Myers-Whaley shovels. Mr. Ingle continued his history-setting pace by double-shifting loading machines starting in 1925.

Work in face preparation in the 1920-30 era included development of CO_2 coal breaking to the commercial stage and the start of work on the Energy Air Miner, which went into use at Royalton No. 7 mine, in Illinois, in 1931.

Improvements in bits for both cutting and drilling were marked by the introduction of detachable bits for augers and the start of work to get something better than the old quenched carbon bit for cutting. A beginning was made on the throw-away type in the 20s, but the main emphasis was on hardsurfacing and heat-treating.

The room-and-pillar system remained the predominate mining approach in this decade, which saw the practical cessation of circular long-walling. The idea of long straight walls, however, was attractive to many mining men then as now. Consequently, the 20s saw such developments as the use of the V-system with chain conveyors at Norton, W. Va.; and considerable work with a longface cutting and loading unit at Gary, W. Va.; another V-system with conveyors at Rachel, W. Va.; still another with scrapers at Coal Creek, Tenn.; and operation of an 800-ft face with a belt conveyor at Derby, Va.

Service to machines was largely limited to mine cars. In 1929, however, the Pittston Co. went to mother and room belts, plus shakers, at Dunmore, Pa., while there were some attempts to produce portable belt units of the quickly extensible type. The major example was the Jones "flitting" conveyor mounted on mine-car trucks, tried at Nellis, W. Va., in 1929.

KEY DEVELOPMENT of the 30s was the introduction of rubber-tired haulage—first the tractor-trailer unit at the left in 1936 and next the shuttle car (opposite page) in 1938. These set the stage for the rubber-tired era in deep mining.

1930-40...

The Pace Quickens

THOUGH THE LOADING MACHINE and the conveyor remained the chief tools in the mechanical-mining kit, with only a moderate amount of attention to the development of other types of units, the 30s brought at least two developments that were to profoundly affect the course of coal in the following years:

1. The NRA put John L. Lewis and the UMW back in business—not only in the old union fields but also in areas where the union had never achieved a foothold or only a very-shaky one. The drumfire of wage increases in the following years put real steam behind the drive to mechanize.

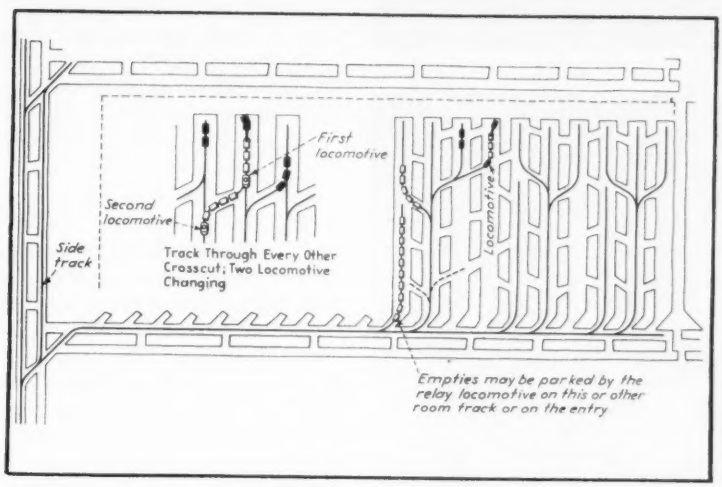
2. Rubber-tired face haulage came into the picture, thus erasing one of the chief bottlenecks in loading-machine operation—getting the coal away. Prior to that time—and even after for a period—the drive had been toward bigger mine cars, better gathering locomotives and track layouts designed to cut down the changing distance. Acceptance of the latter idea was not too often followed by actual carrying out in practice, but it did lead to some use of prefabricated track systems which, when faithfully followed, forced the installation of the necessary switches to assure a short change.

Size of cars for direct loading on track had reached 10 tons in some instances when rubber tires appeared on the scene. The advantages of the big car led, in several instances at mines with small shafts, to the installation of transfer stations in the face zone. Between the face and the transfer station large dropbottom cars with matching locomotives were operated. Major increases in unit output were achieved.

Credit for the introduction of rubber tires goes to the late James H. Fletcher, then a consulting engineer. The first units, installed in the Blue Bird No. 5 mine, Carrier Mills, Ill., in 1935, consisted of Sanford-Day 2-wheeled trailers pulled by Baker-Raulang battery-powered tractors. The trailers, of the dropbottom type, dumped into a hopper sunk into the mine bottom, from which an elevating conveyor transferred the coal to cars on an alongside track.

Elimination of the hopper, and also some of the other complications of the tractor-trailer combination, was the objective in the 4-wheeled self-contained shuttle car, brought out by Joy in 1938. Mr. Fletcher and A. L. Lee then designed a 4-wheel-drive-and-steer car, for the manufacture of which the Lee-Norse Co. was originally organized.

The number of new loader designs dropped off sharply in the 30s—that is, designs by other than the Big Three—Joy, Jeffrey and Goodman. The Umeco was one of the exceptions; the Utility another. Both Goodman and Jeffrey brought out track-mounted machines, Goodman installing its first at the Indiana & Illinois Coal Corp., in Illinois, and the Linton-Summit Coal Co., Indiana, in 1933. The Jeffrey L-400, embodying some of the ideas of the 33-A loader of 1913, which had


First locomotive
Second locomotive
Side track
Track Through Every Other Crosscut; Two Locomotive Changing
Locomotive
Empties may be parked by the relay locomotive on this or other room track or on the entry

LEADING IN MACHINE LOADING in the 30s, the Middle West evolved panel plans suited to its non-pillar-recovery approach. The "key room," as in this one-sided plan, was widely employed to speed up car and machine change.

been developed from the Hamilton of 1903, was offered in 1936. In addition to the 5BU, Joy expanded its line with the 7BU, 8BU, 10BU, 11BU and Joy, Jr.—all stiff-head crawler-mounted machines but having the advantage of not being tied to track.

With this stable of machines, plus the Whaley, Clarkson and certain others, the industry began to settle down and get tonnage—up to 500 to 600 or more per shift, compared to 75 to 125 in the early days of machine loading. Installations in the East and South accelerated but the center of machine loading still was the Middle West as the industry ended the 30s. Here, where pillaring was not the practice, a rather general plan of development evolved. Both one-sided and double-sided panels were employed, the latter in the majority. Usually the operators worked on one side on the advance, or drove up and worked rooms on the retreat, either both sides or alternating from side to side. Panel advancement simultaneous with mining rooms on both sides—another version—resulted in the "fir-tree" system.

The "key room" was a common item. It served as a center access road to 1 or 2 places on either side, normally reached through slanting crosscuts to speed up the locomotive change. Center and side places not being loaded provided storage for empties and loads until the cut or trip was completed.

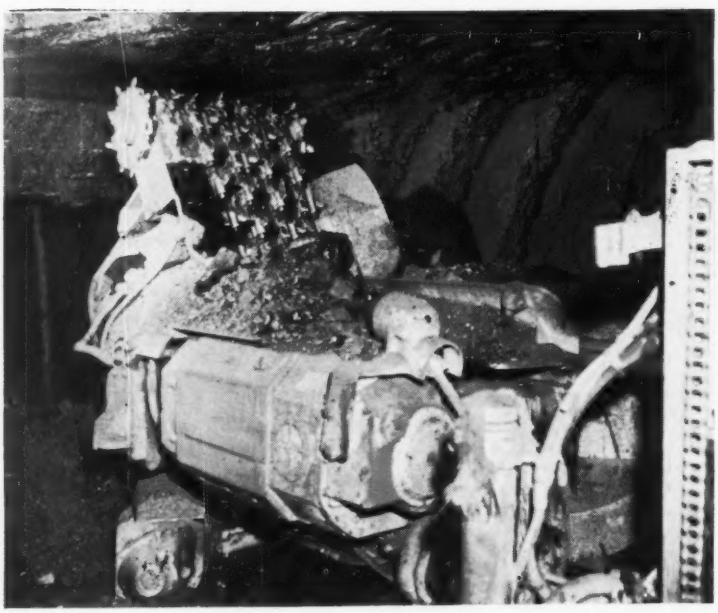
In the East, South and Far West, however, the general practice was to take pillars with little change from hand-loading plans—a tribute to the flexibility of the machines.

Though reduction of machine height early became a design objective the conveyor plus hand loading remained the principal means of coal getting in the thinner veins. Widening use resulted in the development of plans especially suited for this equipment—and for belt haulage in the working sections. Barnes & Tucker Co., Barnesboro, Pa., was one of the first to combine the mother belt with late-type chain conveyors in a retreating panel with pillar extraction—this in 1933. It is still a widely used system, even with loaders and miners and shuttle cars.

In 1933 anthracite provided the first 100% conveyor mine, with Jeffrey belt and chain conveyors and reversible conveyors. The mine was the Harry Taylor, Scranton, Pa. The same general approach, but using machines instead of hand loaders, had been broached as early as 1924 by Walter M. Dake but it was not until 1935, at Goose Creek mine, Hueysville, Ky., that the idea became a reality. But loading into conveyors, and also moving them, was not as easy as it looked, and so after a few trials the practice lapsed until the advent of the bridge and extensible conveyors several years later.

On the face preparation front, though the shortwall held on in substantial numbers, trackmounted cutters, particularly of the universal type, gained more and more ground. Mechanical bugdusters greatly increased machine efficiency and in many cases saved substantially in labor, especially with the shortwalls. Big single- and double-spindle trackmounted drills also were employed in large numbers, while at the same time the small handheld machine also found wider use.

Air coal-breaking with the Energy Air Miner was pioneered at Royalton No. 7 mine, in Illinois, in 1931. Airdox was brought out in 1933. One of the first to adopt it throughout was the Standard Coal Co.



MADE FINALLY POSSIBLE by the tungsten-carbide bit and alloy steel, the mining-and-loading machine became a commercial reality in 1948. Left is the early boring unit; lower left, the early ripper.

1940-50... Continuous Mining Starts

AFTER WELL over half a century of trying the coal industry of the U.S. finally achieved full mining and loading in a single machine in the 40s, applying to it the name "continuous mining." What made it possible was the development of a bit that could take it in the form of a tungsten-carbide cutting element in a tough high-strength holder. Kennametal, Inc., then the McKenna Metals Co., gets the credit for the pioneering. It started work on the idea in 1941 and achieved commercial status in 1944. The first regular, production use was on a shortwall cutter in Waterman (Pa.) mine of the Rochester & Pittsburgh Coal Co. in 1945.

Advances in metallurgy having opened the door, not only in the form of bits but in other machine components that could stand up to direct application of electric power to coal in the solid, two continuous miners were introduced in 1948—the Sunnyhill Coal Co. (later Jeffrey) Colmol and the Joy ripper, acquired from Harold Silver, of the Silver Engineering Co., Denver, who developed it at the suggestion of Carson Smith, a Colorado producer.

In 1948, also, another form of min-

ing and loading—augering—made its commercial bow, with Salem Tool Co. equipment, at the F. & S. Coal Co., Lynco, W. Va., in 1948. The idea came from M. M. Lilly and earlier work, using 9- to 20-in augers, was done under the direction of R. M. McMillan, superintendent of the Becker Sand & Gravel Co., Summersville, W. Va.

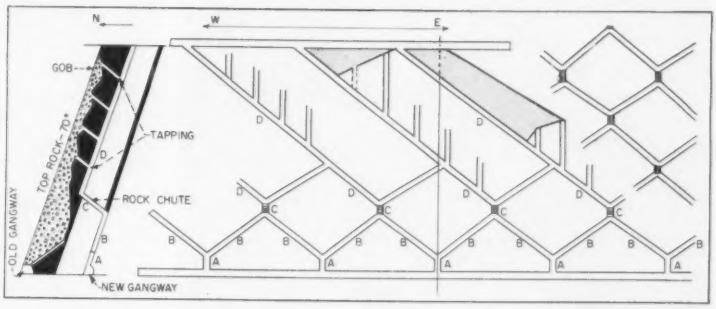
Meantime loader and conveyor installation had preceded at a fast clip, and a new stable of rubber-tired accessory equipment—cutters, drills and the like — had been brought out. "Miniature" rubber-tired haulage units, by Kersey and others, also appeared in this decade for the small truck mines in thin coal. Roof-bolting, which went far toward solving the problem of removing interference from the face zone while providing improved support, also had been introduced in 1946 and 1947 at the No. 7, Buckhorn and Nason mines of the Consolidated Coal Co. of St. Louis, in Illinois, by C. C. Conway.

All this was leading to a substantial increase in tons per man at deep mines, although the full effects were not to be apparent until in the 50s. Nevertheless, deep tons per man in bituminous had climbed to 5.75 in 1950, compared to 4.86 in 1940 and 3.46 in 1910.

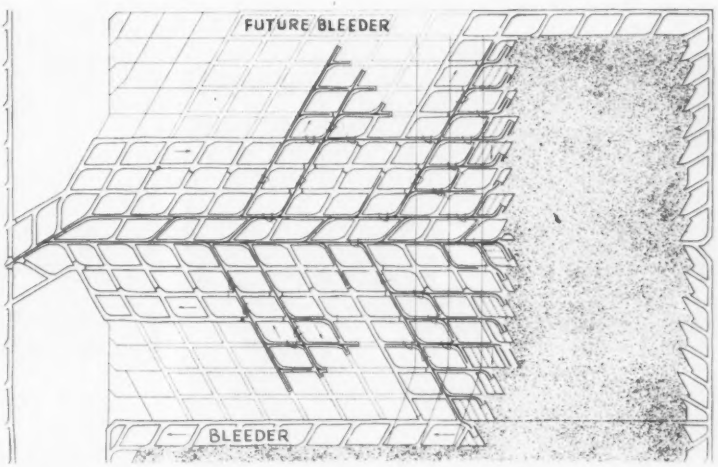
Though mining approaches tend to change slowly, the 1940-50 decade did bring about at least two modifications that might be termed major in nature. One, in bituminous, was a shift to a flat pillar line not over one panel wide and sometimes only 2 or 3 rooms. It was found that the roof-control problem was eased while reduction of weight on points and projections facilitated removal of individual blocks. This system also facilitated the establishment of bleeder openings, now almost standard in the industry and a major contribution to maximum ventilating effectiveness.

In anthracite the gradual disappearance of the oldtime miners willing to face up to the grueling tasks involved in old-fashioned breast-and-pillar recovery had stimulated a search for a method of easing access to working places. Consequently, variations of the "slant-chute" system were widely employed in the 40s in steep-pitch extraction.

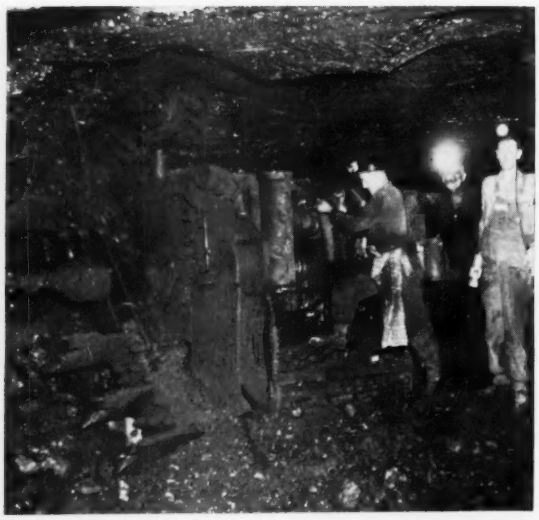
THE FIRST COMMERCIAL AUGER also made its bow in 1948 after some 2 yr of development.

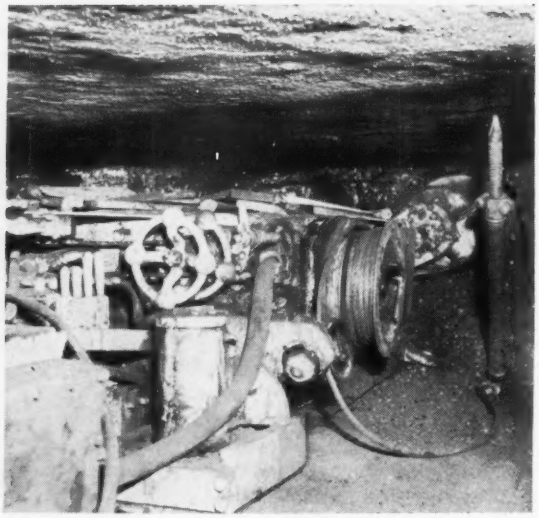


"SLANT-CHUTE" systems to ease the job of the miner were common in anthracite in the 40s.

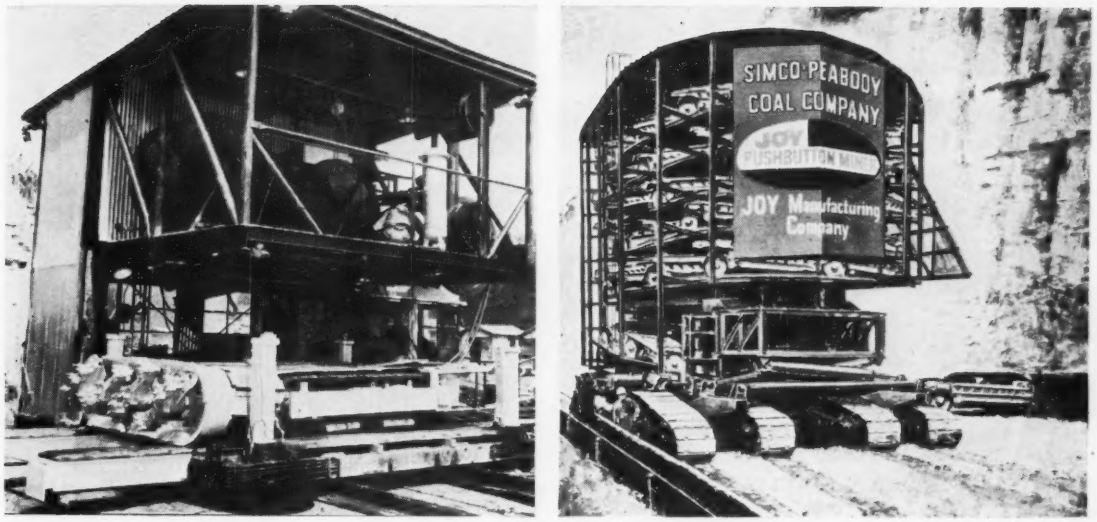


A BASIC CHANGE in the bituminous mining approach in the 40s was the adoption of the flat pillar line of not over panel width. Up to that time the angle line, usually extending over several entries, had been the almost invariable practice for hundreds of years.





CONTINUOUS MINERS introduced in the 1950-60 era included the two boring units (upper left and right), a machine with semi-rigid head (center left), shortwall type (center right), the coal plow (lower left), and an auger (lower right).



FUTURE ROBOT MINERS will count this machine as their daddy. The 1950 version is shown at the left; the 1960 commercial prototype, at the right.

1950-60...
Continuous Mining Accepted

THOUGH BESET by the usual "bugs," the basic advantages of continuous mining resulted in its taking hold practically immediately, with the result that in 1960 continuous machines turned out 77,928,280 tons of bituminous coal and lignite.

With bits making mining-and-loading machines a commercial reality, one result was a jump in the number of designs. Goodman brought out first a ripper-type unit and next the first of the boring machines which are now the backbone of its line. Lee-Norse entered the picture with its semi-rigid-head design, and National Mine Service began further development of the Marietta.

Low coal and transportation have been two of the headaches in designing and operating continuous equipment, just as in the design and operation of any other type of unit. Only now is there any substantial number of units of the room-and-pillar types which can do a creditable job in 3- or 3½-ft coal. One of the first utilized not only a standard shortwall as its power member but also the shortwall principle of operation. This unit is the Wilcox miner, introduced in the East Gulf (W. Va.) No. 3 mine of C. H. Mead in 1956. The principle of twin rotating cutting drums or barrels also distinguishes a Jeffrey machine offered in 1960.

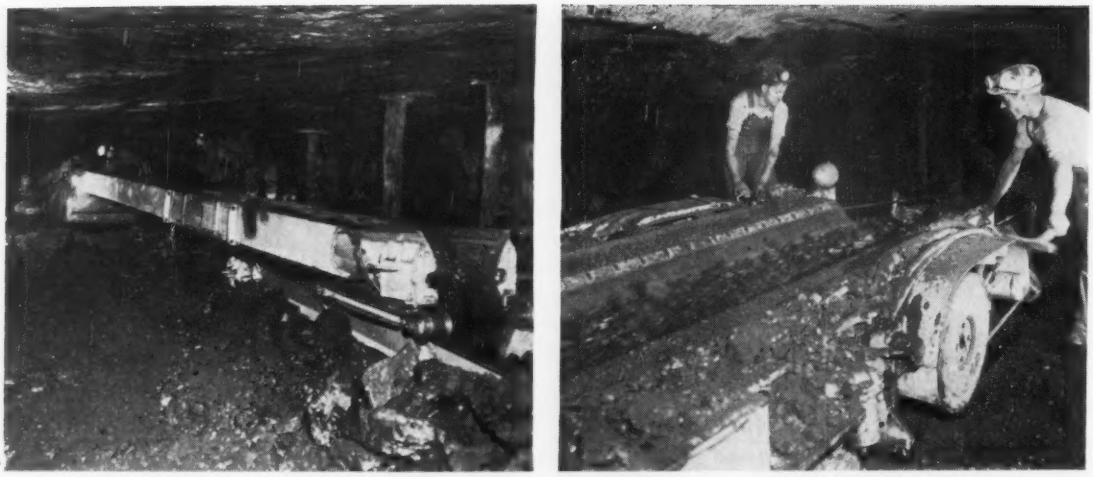
Compton joined the list of auger builders in 1949-50 and, by 1960, in addition to twin-head units, had come up with a machine with a 7-ft single head, installed by Kentucky Oak Mining Co., Hazard, Ky.

Another type of continuous mining which appeared on the scene in this decade employs the longwall principle. It is perhaps the most-logical of all mining principles since equipment moves are eliminated and the system lends itself to attainment of maximum continuity of production. Roof control has been the bugbear in the U.S.

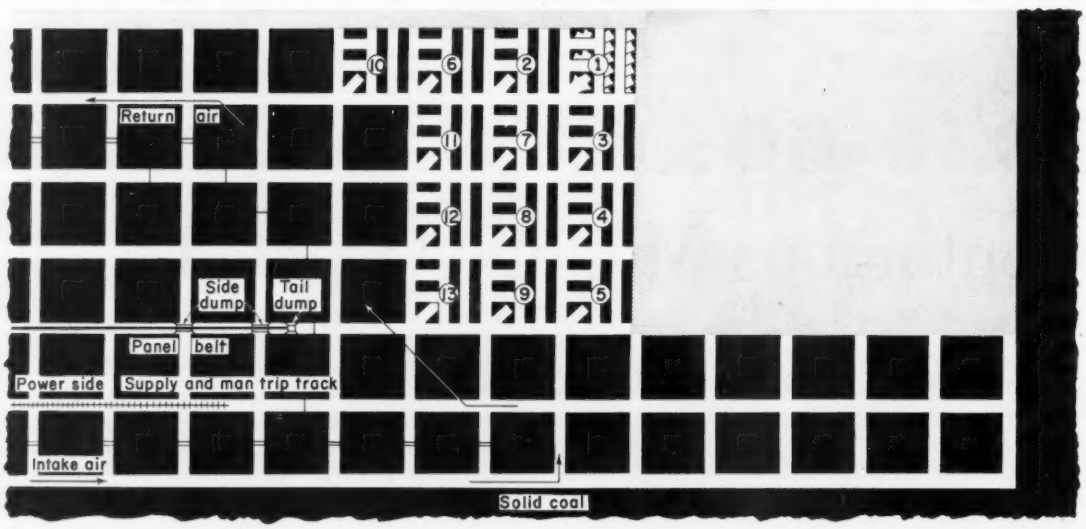
One form of longwall continuous miner is the coal planer or plow. The first in the U.S., using German-made Westfalia Lunen equipment, was at the Stotesbury (W. Va.) mine of Eastern Gas & Fuel Associates, in 1951. Three other units later were installed at other properties, with British equipment at a fourth. Success was not achieved—one of the problems being roof control. In 1960, however, Eastern Gas & Fuel made another try at its Keystone (W. Va.) mine, using an improved Westfalia Lunen support system. Initial results indicate that this system provides the answer.

Coal extraction by remotely controlled machines—or robot miners—was a long-held dream that became a reality in the 1950-60 decade. The job was done by the Carbide & Carbon Chemicals Co., whose interest was in cheap coal for conversion into chemicals. Consequently, it decided to design a remotely controlled machine, doing the work at Quick, W. Va.

The date for the first practical version was 1950. Rights to the unit were acquired by Joy, who rechristened it the "Pushbutton Miner."



FACE-TRANSPORTATION DEVELOPMENTS in the 50s included the original bridge conveyor (left), and the extensible belt (right) to improve continuity of service to the face units.



SLICING PLANS for continuous machines were a 1950-60 development in mining systems. One type is shown here.

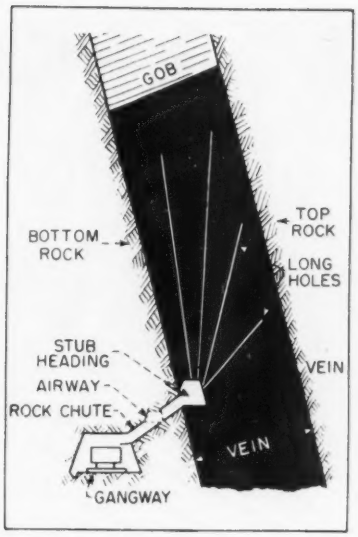
Joy joined with Peabody in building and trying out the prototype unit, starting in 1960, at the Simco-Peabody property in Ohio.

A big advantage of the robot miner is the fact that men are not required to go under roof that is newly exposed and thus is the most hazardous. In fact, the robot unit theoretically makes it unnecessary for men to go under the big majority of the top even with underground types, which will be the next development in this area. The results will include a major reduction in roof-fall deaths, and also elimination of most of the temporary-support cost, which now runs from 25 to 50c a ton at the usual property.

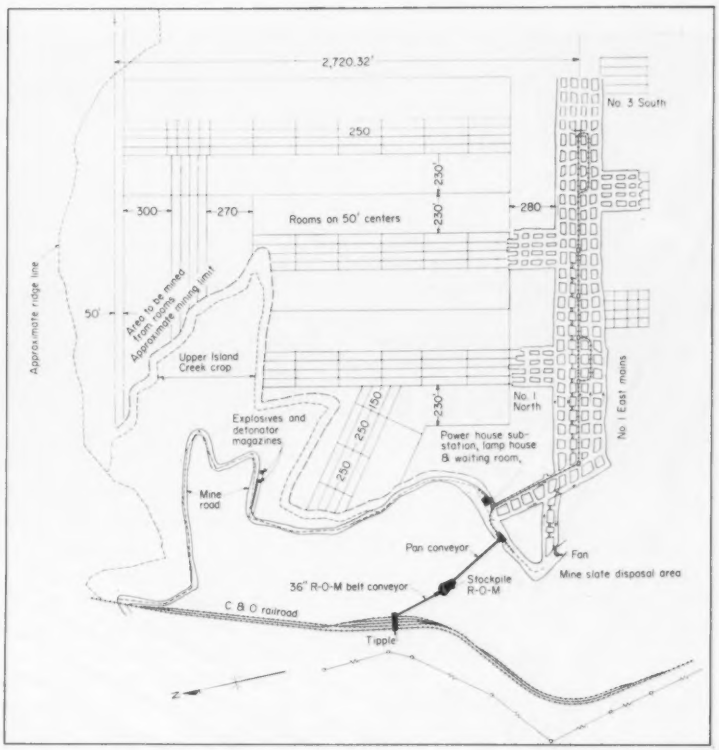
There are, of course, other methods of getting coal out of the solid. One, pioneered abroad, is mining with high-pressure water jets. Experimental work in hydraulic mining in flat coal was undertaken by the USBM in 1959, and later this year the bureau will participate in work in pitching coal in Washington and in Pennsylvania anthracite. But the credit for the first commercial application in coal goes to James E. Anderson, of Coal Inc., Ravensdale, Wash., who developed and applied his own unit starting in 1960.

Other key developments in the 1950-60 era turned on face transportation. This was a problem even back in 1910 with the first of the loaders, but the relatively low production rate of the early continuous miners made everyone painfully aware of basic shortcomings. One immediate result was a renewed consideration of the conveyor. Quick extension and retraction would make the belt an especially suitable unit. Consequently, it was a major objective of the Mining Development Committee of BCR. Joy took over its findings and designs, and its first 1,000-ft 30-in-wide unit found service at the Kittanning (Pa.) mine of Mech Mining Co., in 1954, to serve a remotely controlled Colmol.

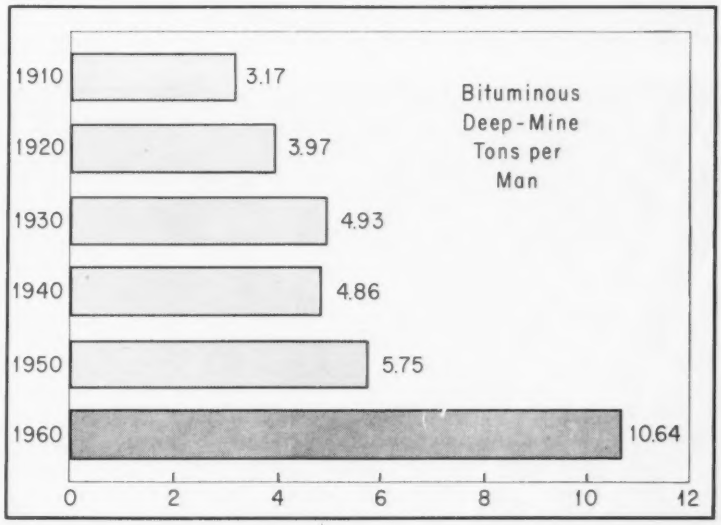
Several other designs were soon offered, but were not the final answer. As a result, the shuttle car has



ONE LONGHOLE PLAN—an increasingly used anthracite plan in the 50s.



PUNCH MINING found wide use in attacking hilltop areas with conventional equipment and successive openings.



THE RESULTS IN THE 50S—a major increase in tons per man in bituminous deep mining as a result of prior developments.

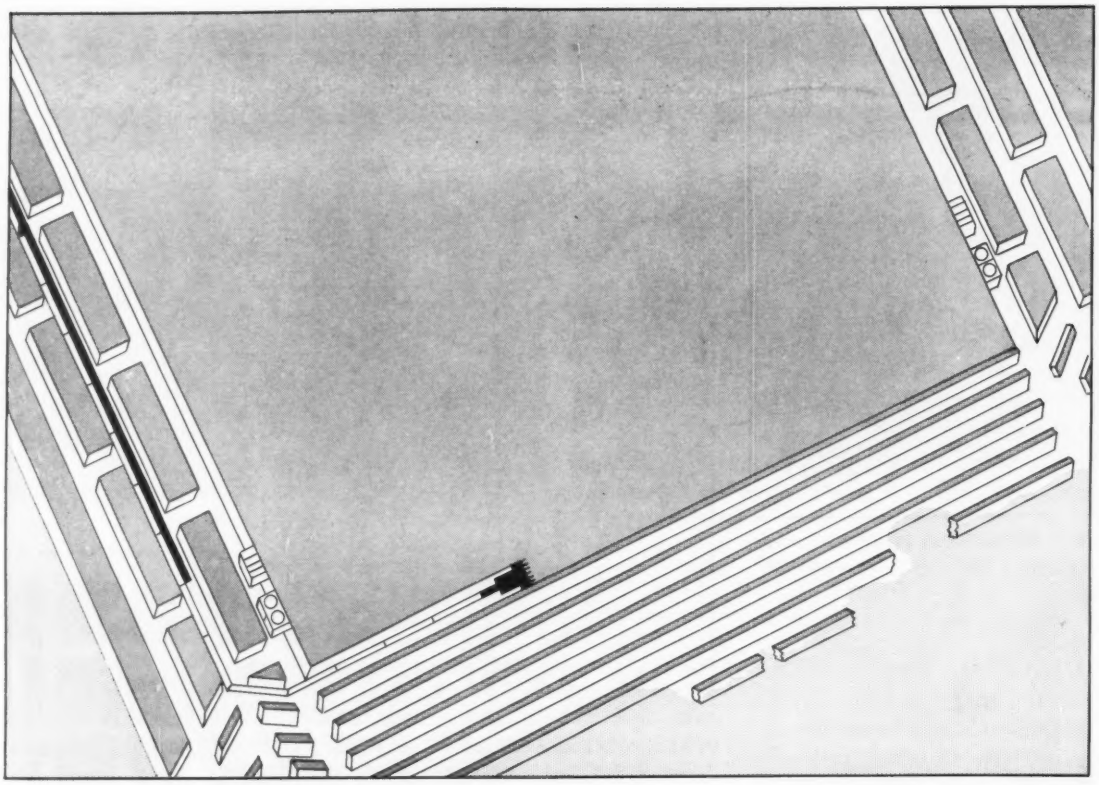
tended to hang on for face transportation. Late improvements, however, are expected to put the extensible belt back in the running—also the cascade unit.

A key item in successful conveyor service today is the bridge conveyor. Bearing the registered name "Piggyback," it was developed by J. B. Long Sr., and first used behind loaders in thin coal at the Crichton No. 5 mine, Nettie, W. Va., in 1950. Improved models now are the foundation of the Long-Airdox "Full-Dimension" mining system.

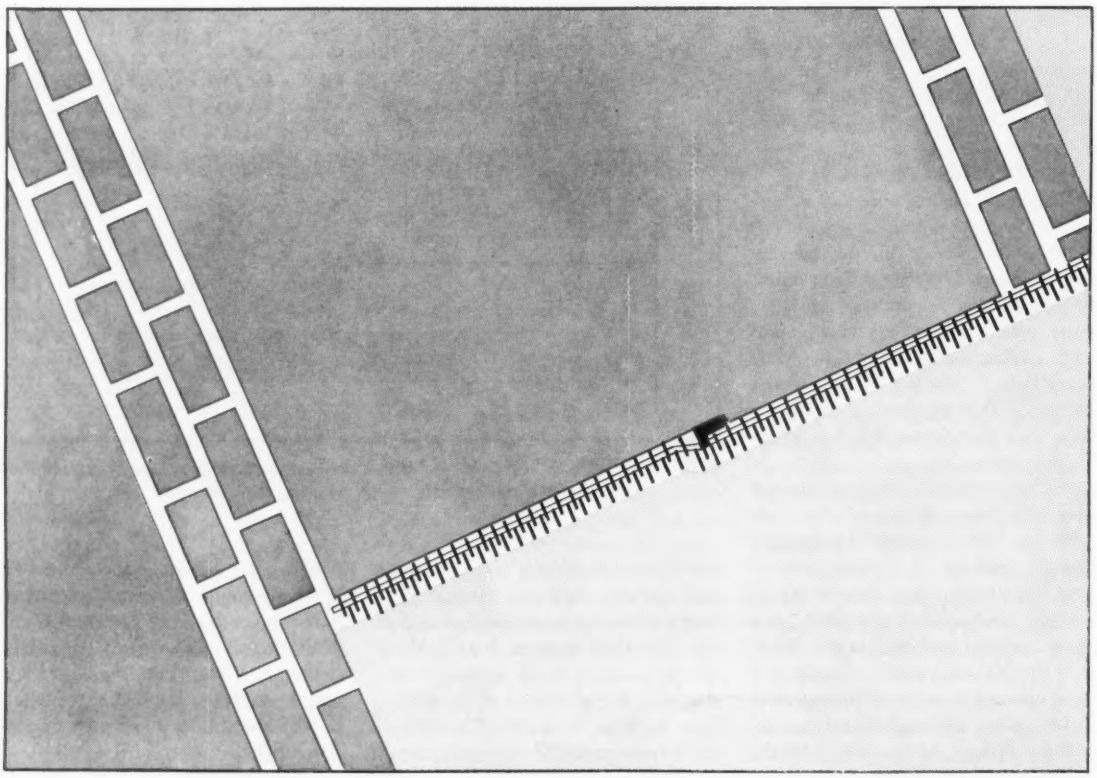
It might be expected that the change in type of mining equipment would be reflected in changes in mining plans. The rise of what might be called the "slicing" system perhaps was the major development with continuous miners. Essentially it consists of driving 4 to 6 places up to 1,000 ft or so deep along the gob, and then removing the pillars on the retreat.

With conventional equipment, but also with miners if desired, the operators of hilltop properties brought "punch mining" to a major state of development in the 50s. In effect, as the accompanying typical plan shows, each panel is a mine. When it is completed a move is made to a new opening or around the outcrop.

In anthracite, longhole mining, involving drilling and shooting off the side of the coal block between upper and lower gangways, moved up to major status as a mining method in the 50s. One of several methods of attack is shown in an accompanying diagram. Development of longholing goes back to the early 30s, when C. A. Garner engaged in a program at Westwood colliery. In the early 40s, W. A. Weineck, blasted large pillars from surface boreholes at Glen Burn. Widespread acceptance began in 1949 after work at Newkirk and Lansford collieries, with Russell Davies and Julian D. Parton as the developers.



LONGWALL in some form or other is a logical plan of mining for the future. The top view shows diagrammatically a plan employing a robot miner with trailing conveyors. Coal ribs protect the face. The lower view shows an open-end longwall with face conveyor and protection by self-advancing props strong enough to withstand any roof pressures encountered.



1960-70...

Automation to the Fore

THE SURVEY of the competitive situation and how it might unfold which appeared earlier in this Golden Anniversary Issue of *Coal Age* resulted in the conclusion that bituminous tonnage could reach 625 to 650 million tons in 1970. That is a lot of coal, though not too different from the peak tonnage so far of 631 million in 1947. But still, compared to today, it is a big tonnage. If it is reached, a lot of new capacity must be provided. Much of it will be deep capacity.

What will a big deep mine involve in 1970? Not all the answers are of course available now, but first it can be concluded that underground things will be very, very simple at these big mines.

If a mining unit could regularly deliver 1,500 tons a shift, and was operated 3 shifts a day—as it would be to cut machine cost per ton—the total production from a two-unit mine in a year of 220 days would be 1,980,000 tons. Looking at the matter one way the biggest job might be driving the several miles that might be necessary to work full retreat. A logical alternative would be advance on one side, with retreat and final mining on the other on the way out. It can be assumed that in the relatively near future machines will regularly deliver 1,500 tons per shift—and much more.

Can it be expected that the years to come will see mining plans that are radically different? Perhaps the future will bring such systems, but it is a good bet that the plans of the future will employ the principles that already have been developed though perhaps not used to any extent for a variety of reasons.

Room-and-pillar has stuck like a bur in the U.S. in spite of the long history of attempts to replace it. The reasons start with the fact that it is simple, easy to work and flexible. Next, it simplifies the problem of roof control, since the coal can be used to keep working places open to the point of final extraction. Finally, the depth of the cover is such that the burden does not require longwall and packwalls as in many areas abroad. So room-and-pillar should be quite prominent in 1970, though it probably will not be used on the same scale as now.

Longwall, as previously noted, is perhaps the most logical of all mining systems. The big drawback to use in the U. S. so far has been practical and effective top support without the cost of packwalls. One answer is to leave coal, and this could result in a plan something like the accompanying one using a remotely controlled miner with articulated conveyors. Thin ribs between openings would provide the support though it would pose a considerable problem in exactly how much coal to leave to avoid such possibilities as total collapse or squeezing, while still getting the maximum extraction.

In addition to the robot miner the auger, even though adding and removing sections cuts down on possible operating time, is a possibility for remote mining in the future. The length across the block being recovered would not be as great, but the same problems of how much coal to leave in the ribs would exist. However, because of their nature, augers would be harder to lose—and if lost completely would represent a lot less money than a miner in case of collapse of the opening before mining was completed. This might permit thinning the ribs down to a very few inches while making the consequences of falls less serious.

If the problem of roof control can be licked the open-end longwall system is a system of real promise. One logical answer is to put enough steel along the face to protect it against any weight that might be encountered—and also to provide strength enough to break the top each time the support system is advanced. Power advancement from a remote point is of course essential, and it also would be essential, if fully remote operation was envisaged, to have a mining machine that would cut full height every foot of the way.

Now, work abroad in particular has progressed to the point where such support systems can be bought and installed in confidence that they will protect a face and keep it open, and that they will break the top and permit normal caving as the face advances. In addition, they collapse, move up and reset themselves—and can do this in response to signals from a remote point.

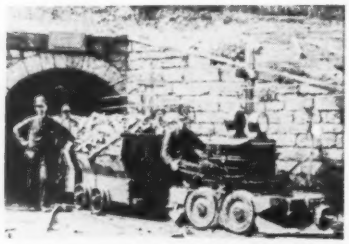
It is logical to conclude, therefore, that longwall with self-moving support systems will be very much in the mining picture in the years ahead. Logically, also, part of the face unit will be a flexible conveyor that the support system will push ahead of it. The actual mining unit might take several forms. The plow is now a widely used miner, and the British, among others, have developed the trepanner.

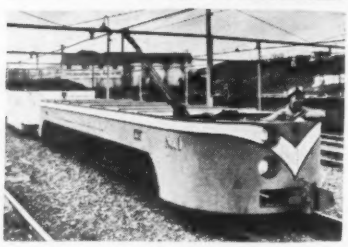
Modifications of these systems will of course appear, assuming they are adopted in any numbers. One already being tested by the British involves driving up the center of a block of coal and then bringing back faces on either side, with a block on one side against the gob. One argument against these plans is the fact that they are intermittent. In other words, production must be stopped at intervals for moving into a new section.

Though pitching coal is a relatively minor percentage of the total mined in the U.S. there still is and will be production from such veins —possibly fairly substantial in the Far West in addition to anthracite. Longholing so far has been about the only fairly-applicable approach to mechanization in mining such veins. A better answer may lie in hydraulicking, now in its early commercial stage in Washington and likely destined for extensive use.

50 Years . . . and Ahead In Face-Supporting Services

Haulage





Locomotives—Early miners called in their women, their children and various and sundry 4-legged animals to carry coal or pull it in some form of container, with or without wheels. It was real work, and not too efficient. Therefore, along with alleviating the equally arduous task of mining or undercutting, one of the first uses of power was in haulage, though it followed after application to mining.

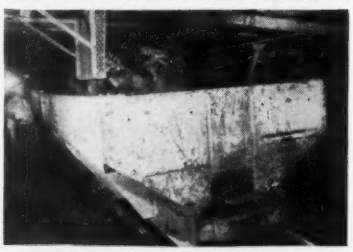
The earliest use of mechanical haulage underground in England was about 1812 or 1813, when George Stephenson was reported to have altered an engine to make it haul cars up an inclined plane. Rope haulage appeared in the U.S. about 1870, also the approximate date of the use of steam locomotives underground. The obvious handicaps and hazards resulted in adoption of compressed-air locomotives—the first about 1882. In 1895 an 8-ton air locomotive for an anthracite colliery was priced at $2,700 f. o. b. Pittsburgh. This would be the equivalent of possibly $15,000 today.

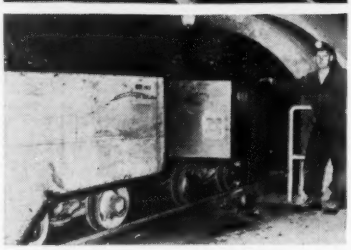
The electric locomotive, however, cleared the slate upon its arrival. The first machine, the "Pioneer," went into the old Lykens Valley Tunnel in the anthracite region in 1887. Total cost, including the generating plant, was $4,700. Hillside Colliery, near Scranton, got the second, a Thomson-Houston machine, in 1889. The "George Upson," built by Jeffrey, was the first bituminous electric locomotive, going into the Shawnee (Ohio) mine of the Upson Coal Co. in 1888. It sported a 20-hp motor and weighed 2 tons all ready to go to work.

Predecessors of the Pocahontas Fuel Co. originated the battery locomotive and also the cable-reel locomotive in the U.S. After trying to develop its own then the company purchased a Jeffrey battery machine in 1889, shortly after acquiring a Baldwin-Westinghouse unit the year before. Anaheim evolved the first-reel machine in 1888 or 89, and O'Malley, Quim and Baker came up with the "Wampus," fitted with a friction-driven reel, in 1900. H. W. Shaffer, shortly after 1902, developed a floating motor-driven reel.

By 1910 the electric locomotive was a fairly standard article of commerce in widening use. Weights had gone up to 15 to 25 tons. Today, weights have reached 50 tons or better, with some machines geared up to 35 to 40 mph. Improved controls and cabs providing motormen with real protection are among the distinguishing features of today's machines, but aside from this and more horsepower, they are close kin to the machines of 1910 and 1911.

May 8, 1951, however, marked a departure in locomotive design that ultimately should find wide acceptance. On that date the USBM approved the diesel locomotive developed by the National Mine Service Co. However, use underground was opposed by John L. Lewis and consequently it still is barred from such service.





Mine Cars—The bituminous mine car, though there was some interest in steel, was either the swinging or lifting-endgate type constructed of wood on a skeleton of car irons in 1910. Capacities generally were 1½ to 2½ tons, and the link-and-pin coupling was practically universal. However, steel and roller bearings figured in the first installation of 60 Sanford-Day dropbottom cars at the Typo (Ky.) mine of the First Creek Coal Co., in 1916.

Solid cars, however, came onto the scene the latter part of the 19th Century, and about 1900 Erskine Ramsay, of TCI, Birmingham, pioneered the dumping of complete trips with an alternative the dump-

ing of 6 cars at a time without uncoupling by use of swivels. In 1908 C. P. Perin adopted the swivel idea for single-car dumping at the Keokee (Va.) mine of a predecessor of Stonega Coke & Coal.

It took the advent of the loading machine to stimulate activity in improving and enlarging mine cars, since it soon was realized that the larger the car the less the time lost in changing and consequently the higher the loader tonnage. Thus, as loaders increased in numbers in the 20s, car size began to rise to 6 to 7 tons and lightweight high-strength alloys began to come in in the 30s, though some had been used earlier. The use of automatic couplers in some numbers also began in the 30s.

The shuttle car quickly ousted track and cars for face service, but the advantages of size, lighter weight and lower maintenance has kept size on the way up to 25 tons or better. Welding now is standard in car construction, having come in in the early 30s. It was used in constructing 1,000 ACF cars for Rochester & Pittsburgh, as an example, in 1932 and 33.

Now steel is being challenged by aluminum. An experimental Watt aluminum car was installed in the Ireland mine, Moundsville, W. Va., in 1959, and this year an order for 125 units was placed with Irwin-Sensenich by Eastern Gas & Fuel after 2 yr of trial with an experimental installation.

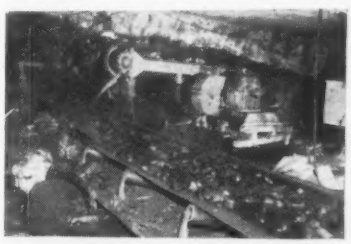
Automatic Trip Loading—Though several companies (Stamler and Nolan, for example) now offer automatic trip-loading stations the pioneer work was done at the Hendrix (Ky.) mine of the Consolidation Coal Co. (now Bethlehem) by S. M. Cassidy. The date was 1952, and the first installation, with 25-ton cars, was on an outside haul receiving coal from an entry-driving belt.

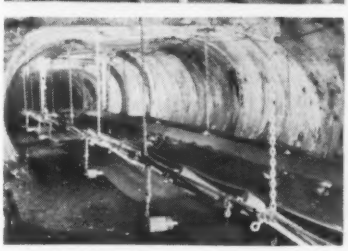
Track—The coming of the locomotive brought the steel rail into the picture. Before that, the mine track consisted of wooden rails on ties of the same material. The ties for main lines still are wood—treated, however, these days—and rail weight has grown from 12 and 16 lb per yd to 90 and 110.

Wood ties, however, were a costly item when track had to be kept up to every working face. Consequently investigation of the possibilities of reuseable steel ties goes back to the 1890s. Several types were available in the 1900-1910 decade, with others, of course, later.

Welding of rails on main lines is another milestone of the 30s. Thermit welding, for example, was employed at Willow Grove No. 10 mine, of Hanna, in 1935. This followed an earlier installation at New Monarch, in Illinois, in 1933. Bronze welding also was widely employed for a time, though steel welding was soon adopted for cost reasons. It and Thermit now account for the majority of such work.

Mechanical tamping is the latest innovation in track work. Using a Fletcher-designed unit, plus special ballast-spreading cars, it was pioneered at the Mathies (Pa.) mine of Mathies Coal Co., in 1959.





Belt Conveyors—Conveyor use underground dates back to the chain units installed at the Vintondale (Pa.) mine of the Vinton Collieries Co., in 1902. Belt use on any scale underground did not take place until 1924, when the Pennsylvania Coal & Coke Corp. installed face and mainline belts at Ehrenfeld, Pa., and the H. C. Frick Coke Co. started its Colonial Docks system with a length of 22,930—one 60-in and 19 48-in belts. The first all-conveyor mine was the Harry Taylor, near Scranton, Pa., in 1933.

Though there are several mainline installations in service, the belt has found its greatest application in mother, extensible and similar service. The big breakthrough in design in modern times was the development of the ropeframe conveyor by Joseph Craggs and Keith McCann at the No. 17 mine of Peabody in 1955. This became the Goodman Ropebelt and set the pattern for all the succeeding ropeframe development.

Key events in belt material themselves were the introduction of neoprene for fire-resistance in the 40s followed by PVC, with Scandura the first in 1953 at several southern West Virginia mines. The PVC belt also marked the entrance of the solid carcass into the field of belt construction. It has since largely taken over in most applications where permanent vulcanized splices are not required. Previously, however, ply-type construction had been radically improved by the use of nylon, rayon and even steel cords. One result was a sharp jump in the length of individual sections, reducing, among other things, the number of drives for a given distance in long lines.

Hoisting—Some shafts still are being constructed where the coal lies below drainage, but they are few. Where they are employed for coal hoisting, the tendency is to make them automatic. This practice dates back to 40s, when installations were made in Pennsylvania and Indiana.

The belt slope, however, now is the preferred hoisting medium. The idea of using conveyors for hoisting goes back roughly a half century, and a number of steel-apron units were employed prior to 1920. Belts began to be used for surface work about 1910, but by 1923 at least one was in service at the Lewis mine of the Hudson Coal Co., Clarksburg, W. Va. (247 ft, 18 deg), while a 485-ft unit on 19 deg 53 min was being installed by the DeBardeleben Coal Corp. at Townley, Ala. By 1930 improvements in belts and methods of applying them had proceeded to the point where an installation with a capacity of 1,000 tph, 900 ft between centers on a pitch of 18 deg, was made at the Wildwood (Pa.) mine of the Butler Consolidated Coal Co.

Biggest of all to this date in terms of total lift is the slope belt serving the Orient No. 3 mine of the Freeman Coal Mining Co., Waltonville, Ill. Engineered by Link-Belt, the center-to-center distance is 3,300 ft and the total lift (16-deg inclination) is 868 ft. Width of the steel-cord belt is 42 in and rated capacity is 1,200 tph. Orient 3 produced its first pillar coal in 1951.

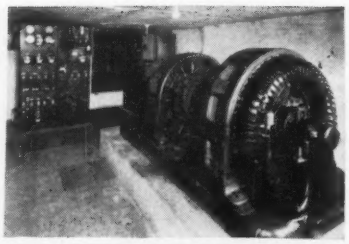
The Haulage Future—Coal could be pumped from the face to the outside—and already has been, for that matter—some arguing that since you are going to wash it anyhow you might as well put it in water as soon as you mine it. Or perhaps it could be conveyed pneumatically.

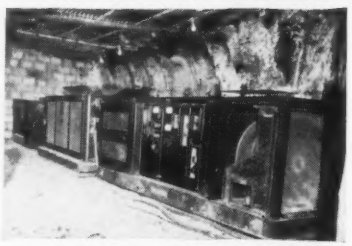
There is little in the picture, however, in spite of speculations such as these, to indicate that haulage and hoisting will be radically different 10 yr from now. The trend to bigger cars and locomotives will continue, and aluminum apparently is scheduled to make headway as a construction material. The Scottish cable belt may be added to the belt types now being employed for haulage and hoisting. And the bar against the diesel should be lifted in the near future, which should mean active installation of this type of equipment shortly thereafter.

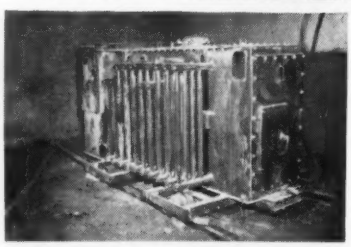
More shaft hoisting may be in the picture in the future because the trend is toward operation under deeper cover. When hoists are employed they will be automatic, but further improvements in belts and conveyors may keep the conveyor slope from losing much ground in spite of increasing depth.

Power

Steam and compressed air ruled the roost in coal mining in the U.S. until 1887, when the Hillside Coal & Iron Co., in the northern anthracite region, installed an arc-lighting system and the Lykens Valley Coal Co. put the first electric locomotive into service. It was DC of course, and the generating plant came with it. Because the traction motor is peculiarly a DC machine and because few men were interested in AC, let







alone the complications of a dual system, DC was it for all practical purposes underground until relatively recently.

However, the use of AC underground was tried at Rugby, Colo., in 1912. Even before, however, the difficulties of long-distance transmission of DC had led to the idea of taking AC close to face and then converting. This was the goal in a G.E. plant for the Webster Coal & Coke Co., Ehrenfeld, Pa., in 1901. The voltage to the converter was 5,600 with the converter in turn providing 275 V DC.

"Complete" electrification of mines, meaning displacement of steam engines, began about 1911, with AC growing on the surface and DC, of course, underground. The DC sources were rotary converters and motor-generator sets which held on until the mercury-arc rectifier was introduced in 1927 in the form of a 350-kw 550-V Brown-Boveri tank-type unit in the Appalachian Power Co. substation at Rolfe mine of the Pocahontas Fuel Co., Worth, W. Va. Glen Alden experimented with a 275-V machine in 1930. In 1936 the Ignitron rectifier with individual tubes instead of a tank was offered by Westinghouse. Thereafter the rectifier gained ground rapidly and now is almost universal for converting AC to DC. Now, silicon types are making their appearance.

Where cables were employed to feed underground substations, the originals were armored. About 1914, however, Lehigh Navigation installed several nonmetallic cables in boreholes at Lansford, Pa., initiating a practice now widely employed.

Like many other things, the use of machine loading and the consequent parallel rise in power requirements affected the distribution setup. Among other things there was a need for a convenient and safe means of taking several cables off from a central point, as well as a need for protecting both machines and operators against overloads, shorts and grounds, plus an additional need for connectors that could be employed in gas and could not be joined or disconnected with power on.

Early forms of junction and distribution boxes began to appear in some numbers in the 30s—some merely providing connection facilities and others circuit-breaker or fuse protection also. Further development of the all-purpose distribution unit resulted in the present-day types that provide for automatic power-off making and breaking of connections, overload protection and safety grounding. Cable connectors also incorporate the same power-off feature.

The solid safety ground wire was for many years the only practicable protection for men, though it had its less-desirable features. Research for several years by the USBM and others resulted in the development of the ground-detection relay functioning without a grounding conductor. The first of these was offered by National Mine Service in 1956.

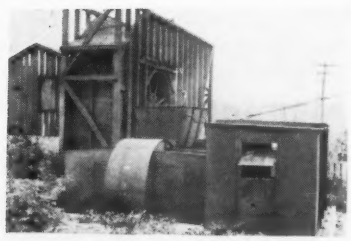
Though AC is definitely advantageous in the operation of face equipment the need for DC for haulage continued to hold back adoption until quite recently, though the construction of all-conveyor properties in the 30s and 40s resulted in some increase in its use.

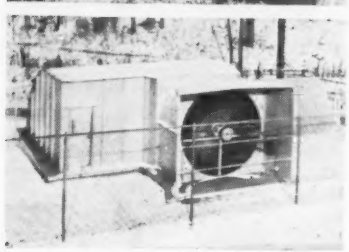
Haulage remained the bugaboo, however, until 1956, when the torque-converter car developed by

Consol and taken over by National Mine Service was introduced, followed by the Joy 2-speed AC car. This made possible the use of AC in section haulage—the critical area—and resulted in an immediate swing to AC in the face zone, though DC was still necessary in haulage unless conveyors were employed.

Earlier in 1951, as previously noted, the USBM approved the NMS diesel locomotive. When the bar to its use is lifted by the union, the last big difficulty in full AC mining will be removed.

Ventilation





As soon as the first miner got a little way into the ground the problem of air supply popped up. It grew as mines increased in size. In addition to "natural" coursing, the early miners used falling water or a current of heated air from a furnace to establish circulation. Air pumps were among the first of the mechanical devices, then fans.

Early fans were of the centrifugal type and apparently the first in the U.S. was at Locustdale, in the anthracite region in 1857 or 58. Furnaces, however, hung on in considerable numbers up to the date of the establishment of *Coal Age* in 1911—and even later. But they eventually were put out of business by the centrifugal fan. It later was supplemented by the disk, with the two monopolizing the field until 1931, when the first of the modern propellor-type fans, in this instance the Jeffrey Aerovane, was installed by the Republic Steel Corp. at Uniontown, Pa. The propellor type now is universally employed in new installations.

Doors were of course one of the first devices employed for the control of ventilation. Automatic designs came early—the first by N. K. Bowman in 1895. In the summer of 1898 the first of a long series of automatics, in which it still specializes, was installed by the American Mine Door Co. in No. 3 Minglewood mine, Jas. Mullins Coal Co., North Lawrence, Ohio. Tubing and tubing blowers were early developments, along with booster fans underground. All new installations, however, were banned in the Federal Mine Safety Code of 1946. The gas problems resulting from continuous-miner operation has, however, resulted in some relaxation of this prohibition, with more scheduled for the future.

The rising cost of air losses and the growing gas problem already had resulted in a change in thinking on ventilation. As a result, the goal became one-way travel to the maximum extent possible, rather than bringing everything all the way back to the fan. Drift openings or conventional shafts were the first means of achieving such travel. The cost of conventional shafts, however, resulted in the employment of big-hole drilling as soon as it became practicable.

A number of mines, in Indiana and elsewhere, started with 10- and 12-in holes, but the size soon increased. One of the first to put down a hole big enough to accommodate an emergency escape cage was the Lorain Coal & Dock Co. In 1948 it drilled a shaft 48 in in diameter and 202 ft deep. Now, drilling is common, with, for example, holes up to 76 in in size and 698 ft deep, as at mines of the Olga Coal Co., which put its first hole down in 1950. In 1954, Victor Zeni employed a new design of drill to make a 72-in air and main shaft for the Trotter Coal Co., in Northern West Virginia.

Air coursing in the early days generally was continuous, or with as few splits as possible in spite of the relatively early recognition of the value of such splitting. The concentration involved in mechanical mining, however, lead to the greater use of the panel and to wider acceptance of the idea of providing each panel with its own split.

As in overall mine ventilation, one-way travel across a panel from active working toward the gob has major advantages. But places for the air to leave must be provided, which led to increasing acceptance of the idea of bleeder headings in the late 40s. Bleeders also provide, in most instance, alternate escape routes. For these and other reasons they are now practically standard.

What might be termed the even tenor of progress in ventilation was upset by the advent of the continuous miner in 1948 and its increasing use in the 50s. The high sustained yield of coal in a single place was accompanied by a greatly increased flow of gas, while the none-too-easy job of getting air to the face zone was complicated by the fact that the boring-type machines, in particular, fill the opening.

Line brattice was the first answer and in many operations has been found quite satisfactory. Now, the old-reliable jute and cotton is being challenged by plastic sheeting. This was first employed for temporary stoppings at mines of the West Kentucky Coal Co., starting in 1947.

The seriousness of the problem also brought the tubing blower—or exhauster—back into favor. In some instances, two are employed per place to achieve the necessary air flow and, more important, complete sweeping of the face.

Rather than handle the gas after it is released major consideration now is being given to trying to drain it off in advance of mining. One system, developed by Christopher Coal Co. in 1959 at Humphrey No. 7 mine, is drilling outwardly slanting holes from the outside ribs of outside airways in entry advancement to bleed gas directly into the return. Initial drainage was under natural pressure but arrangements were made for water infusion. This appreciably increased gas flow.

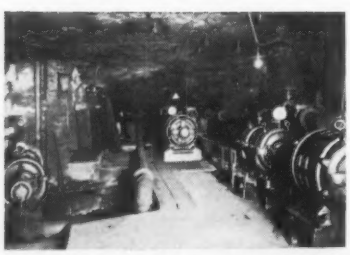
Humphrey No. 7 also had been the site of earlier experiments in draining off methane by boreholes from the surface. Credit for this idea, however, goes back to at least

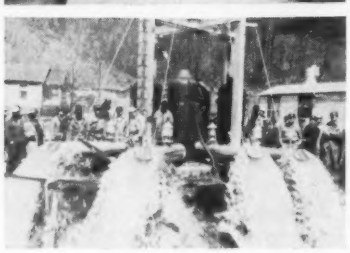
1911, when the West Kentucky Coal Co. tried borehole drainage.

The Humphrey experiments, with the USBM and the W. Va. School of Mines, involved first suction on the borehole, which also had been tried by the Pocahontas Fuel Co. prior to 1943. Next the coal between the advancing workings was infused. Promising results were attained.

The Ventilation Future—Borehole degasification, probably with water infusion for greater effectiveness and also to help with the dust problem, quite likely will be a common practice where gas volumes are great—also drilling ahead underground. More drilling and bigger holes are the prospects in the field of outlying openings to cut air travel and provide emergency escapeways. The use of blowers and tubing underground to get air to the actual working face will increase.

Pumping and Drainage





Pumping in coal mining was, as might be expected, first done by hand and then by steam. It was about 50 yr ago that the centrifugal pump began to be used in some numbers, though earlier installations included a bronze single-stage machine at a mine of what is now Glen Alden in the anthracite region. Six-stage pumps were installed by the same company in 1905 and 1908. Anthracite also was an early user of major water tunnels, such as the Jeddo, 15,100 ft, 1893-95; the Forest City-Coalbrook tunnel; the Lausanne, by Lehigh Navigation, 1906-12, eventually reaching a length of 13 mi; and, about the same time, the 5,600-ft Oneida tunnel by Lehigh Valley. In bituminous, a famous old tunnel was the Hoffman, 10,646 ft long, in the Georges Creek field of Maryland.

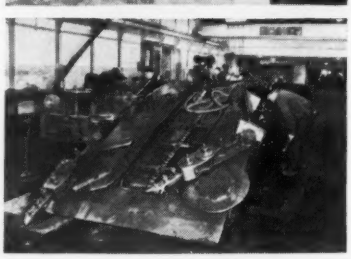
The centrifugal pump, as noted, took over for main dewatering service beginning about 1911. Some 10 yr later, small gathering pumps of the centrifugal type were developed. In 1922, following a suggestion of J. T. Jennings, electrical engineer for Philadelphia & Reading, a priming device was developed and incorporated in a completely automatic station worked out by Otto Haentjens, B. M. Horter and G. V. Woody for Draper Colliery—later at Kohinoor and Boston, all three in the southern anthracite field. Deep-well pumps made their appearance around 1913, but it was not until in the 30s that extensive use began.

Acid water was an early problem not only with pumps, which led to not only the use of bronze and numerous alloys, including stainless, but also to such steps as lining the cylinders of reciprocating units with vitreous china. Now, of course, rubber-lined centrifugals are common. Lining also was resorted to to prolong pipe life—first with cement as early as 1914, and also rubber. Complete hard-rubber pipe was introduced in 1930, and a predecessor of asbestos-cement pipe was used as early as 1914. Copper-bearing and other alloys also were employed, and wood pipe was used in very early pumping days.

The advent of plastic pipe in 1948, Carlon leading in its introduction, not only took care of most of the corrosion problem but also cut the cost of the pipe itself as well as the cost of laying it. Earlier the problems of weight, particularly in gathering lines, had been tackled by going to aluminum. The first user was the New River Co., in southern West Virginia, starting in 1948.

The problem of quick joining of pipe—metallic and otherwise—was eased materially by the introduction of the Victualic coupling. An early user was Consol of Ky. in 1946, and these couplings also were employed in the New River aluminum lines. Grooving was required for Victualic and other early versions of these couplings. Since a great deal of the wall thickness of pipe is required solely to permit threading or grooving, the idea of rolling grooves was hit upon by Victualic. This permitted the use of thin-walled steel and aluminum tubing at a considerable saving in both purchase and installation costs for both water—pumping and sprinkling—and air. One of the earliest users of such tubing on a major scale was Island Creek at its southern West Virginia properties, starting in 1956.

Maintenance



Mining men 50 yr ago tended more to concentrate on making repairs after breakdowns than preventing the breakdowns in the first place—this attitude probably reflecting the relatively lower importance of machinery in the scheme of things. Today, the emphasis is on keeping machines working because now when a machine is not producing the costs, labor included, go right on, whereas in the old days if a hand loader didn't load the company incurred no outlay.

The stages in the transition from one viewpoint to the other match the stages in the use, first, of loading

machines and, second, continuous miners. First the realization was driven home that it was essential to prevent breakdowns, which led to the development of preventive measures, including stationing electricians and mechanics in the working sections.

It also became apparent quite soon that records of delays and their causes were major tools in achieving a higher percentage of operating time, as well as pinpointing not only weak points but also where responsibility should rest for failure to lubricate, for example, as well as improper operation, abuse, etc. Daily, weekly, monthly and other inspections became standard procedure at mines with low breakdown times.

Some of the key developments in maintenance of underground and certain other production equipment are as follows:

Welding by the Thermit and gas processes around 1911.

Arc-welding for tire filling and similar applications in the 20s.

Antifriction bearings, around 1911.

Centralized lubrication—by hand-operated injectors, in 1923; motor-driven pump, Ideal Lubricator Co., before 1928; portable lubricating trucks around 1930; and Lincoln and Trabon centralized systems on mining equipment in the 50s.

Alloy and special steels as far back as 1890, with accelerated progress since the 30s. Aluminum came into significant use about the same time.

Rubber-sheathed trailing cables in 1920 and following years, with neoprene coming in for jacketing material in the 40s.

Asbestos-covered wire for heat resisting windings in the 20s, with silicones in the 40s.

Unit changeout of machine assemblies starting in the 30s.

The Maintenance Future—A major development of the future in the field of maintenance will be the increased design and manufacture of equipment that will be practically immune to breakdown. The cost will be up to 50 to 100% more but it will be much more than repaid by the increased production time that will result.

Special training of maintenance men in schools and on the job already is being carried on to some extent. Since the maintenance man will be more and more a key man, and since the proportion of such men will rise, formal training involving considerable time will be more and more the practice in the years ahead.

Supplies

In the 50 yr from 1911, the cost of operating supplies and repair parts has gone from probably 5% or less of total cost to 20% or so today. One reason for the low cost of 50 yr ago and earlier was hand loading on a contract basis, with most rates contemplating the miner furnishing tools and such supply items as blasting powder, fuel for cap lamps and so on. Timber and ties in those days probably were the big supply items at most mines.

As the situation began to change with the rise of the machine, and also new contract clauses requiring the company to furnish all tools, a number of new approaches were evolved.

1. Better facilities for receiving, storing and issuing supplies were necessary, with the result that the supply houses and yards of today are big, mechanized with handling equipment, and modern in design and equipment, including bins and shelving. Special storage buildings for oil and certain other items now are common.

2. Control of inventory became more essential as the volume of material and parts rose. Now, at the big plants, computers are being called upon to keep investment at the proper level consonant with use.

3. Orderly requisition of materials and parts became essential to permit proper costing and prevent waste. Though not all properties require a specific destination—section, machine and so on—it is now the majority rule, compared to minority status as late as the 40s and early 50s.

4. Orderly replenishment of supply became essential along with requisitioning to make sure (a) that the operation was not caught short in critical items or (b) excessive ordering resulted in exceeding the desired inventory level.

5. Delivery methods were tightened up for higher efficiency and steps were taken to protect supplies and parts at the delivery point until they are needed. The advent of trackless mining was responsible for perhaps the major change in distribution methods, since rails were no longer available for delivery directly to the room neck or face. Special rubber-tired trucks were one answer, though the shuttle car itself was soon pressed into service.

In the early days of mother belts —and still on some occasions—they were made reversible to handle supplies in the panels. But reversing results in problems and when rubber-tired equipment became available it usually got the nod, though at some properties track is laid parallel with the belt either for direct delivery or delivering to wheeled units.

Special flat-topped and other cars for such items as roof bolts, capboards, lumber and the like were a development primarily of the 40s and 50s. The latter decade brought in the practice of prepackaging materials into bundles for direct delivery via rubber-tired units, or to transfer stations—some equipped with monorail hoists to ease and speed up the job of reloading into shuttle cars or other distributing equipment.

A Half Century in Stripping . . .

STRIP MINING is as old as the coal industry. Primitive miners, working along the outcrop, could do little else but quarry their output, at first disposing of the spoil by hand and later employing wheelbarrows and carts. When the overburden became too heavy for hand removal, horses or other draft animals with plows and slip scrapers were employed. Traces of wheelbarrow runs used in working early strippings, prior to 1820, may still be seen at, for example, Summit Hill, in the Pennsylvania anthracite region.

Mechanization of stripping in the U. S. is the outgrowth of the invention of the steam shovel in 1839 by Otis, who was killed trying it out. An Otis shovel was applied to bituminous stripping in 1877 by Hodges and Armil, who started stripping with teams, plows and scrapers in the Pittsburg (Kan.) field in 1876. In 1881, C. Pardee embarked on extensive stripping, using a 1-yd machine, at Hollywood colliery, near Hazleton, Pa. At that time it was considered that 1 ft of overburden could be removed with profit per foot of coal, even though the coal was partly mined.

Bituminous stripping, though work went on elsewhere, really was cradled in the Danville district of Illinois. Kirkland, Blakeney & Graves opened a plow-and-scraper stripping at Grape Creek in 1866, and in 1875 Michael Kelly started another operation at Hungry Hollow.

After Hodges and Armil, a river bottom near Danville, known as Missionfield, was the site of the second mechanical stripping operation. Wright & Wallace bought a Merion dredge (minus the hull), which they placed on wheels. Built of wood with a boom 50 ft long, the machine made a cut about 20 ft wide. Removal of 400 cu yd of overburden in 8 hr was considered phenomenal. Butler Bros., who had previously employed draglines in ballast-burning in Missouri, next took a crack at Missionfield with three draglines—¾, ⅞ and 1 cu yd. Boom lengths were 80 ft. In 1900, Butler Bros. installed a 2-yd drag with 135-ft (later 115-ft) boom.

First Modern Strippers

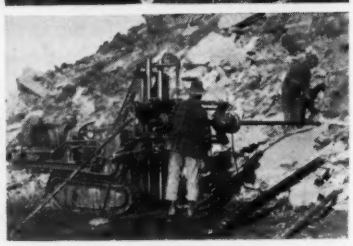
A stacker in combination with a shovel was installed by Turner and Prutsman in 1904, and in succeeding years a number of shovels were put to work in various areas. Up to 1911, however, stripping had been attended by more grief than profit. In that year the first step toward the success that now characterizes stripping was taken by Grant Holmes, W. G. Hartshorn and R. H. Sherwood. Mr. Sherwood continued on to become a highly successful strip operator in Indiana and Illinois, consolidating his interests under the name of the present Stonefort Corp. shortly before his passing, a few years ago.

What the three came up with was a Marion-built full-revolving machine with hydraulic equalizing jacks, 65-ft boom and 3½-cu yd dipper on 40-ft stick. This went into Missionfield a few months before *Coal Age* went into business in October, 1911. The following year Bucyrus brought out the first of its heavy revolving shovels with 3-point suspension and screw jacks to keep the frame level.

The arrival of the modern-type stripping unit in 1911, however, did not solve all the industry's problems. Strip coal under early production conditions had, perhaps deservedly, a bad name and generally sold at prices substantially under those for deep-mined coal. But with increased use of equipment permitting the handling of overburden up to 35 to 50 ft and, within a relatively few years, 50 to 60 ft, better coal could be uncovered. Also, the strip miners of the Middle West and Southwest were among the first to go to mechanical cleaning. Consequently, by the latter part of the 30s there normally was little distinction made by purchasers until the East and South began to go

1910-20

1920-30



1930-40

And the Next 10 Years

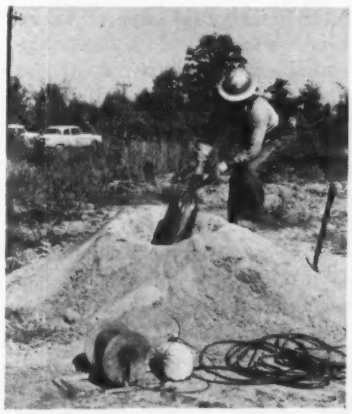
in for hillside production shortly before but particularly during and after World War II, turning out considerable oxidized and rusty coal in the process of opening up first and second cuts.

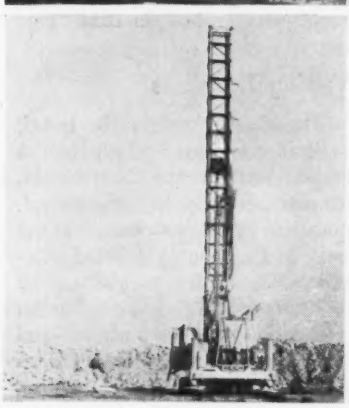
Upping excavator size followed almost immediately upon the completion of the Missionfield machine. Ellsworth-Klaner Construction Co. started a 5-yd machine (around $50,000) in 1912. A number of 6-yd machines were in service in 1915, including one operated by Alko-Nak at Henryetta, Okla., with 85-ft boom reported to be averaging 9,000 cu yd per 9-hr day. Possibly the earliest full-revolving loading shovel was that installed in 1912 by the T. J. Forschner Coal Co., Linton, Ind.

Electrification

Although steam was to hang on for many years, work on electrifying shovels got under way in 1912. In 1915 Piney Fork Coal Co. installed an electric stripper (G.E. AC motor and controls) with 90-ft boom and

1940-50





1950-60

1960-70

6-yd dipper. A similar unit, with 8-yd dipper, 95-ft boom and 45-ft stick, was put in service at Rush Run, Ohio, by the owners of Beech Flats Coal Co.

In 1926, a 8-cu yd *crawler-mounted* machine with 90-ft boom and 56-ft stick was put into service at the Cuba (Ill.) property of the United Electric Coal Cos. It handled 176,079 cu yd of overburden in July, 1926. In that same year, in Indiana, the Enos Coal Mining Co. pioneered the use of L.O.X. (liquid oxygen) as the main explosive in shooting overburden.

Tandem operation was inaugurated by, among other companies, the Northern Illinois Coal Corp. in the old Braidwood-Coal City-Wilmington field. The machines were a shovel with 12-yd dipper, 90-ft boom and 60-ft stick, teamed up with a dragline with 150-ft boom and cast manganese-steel bucket.

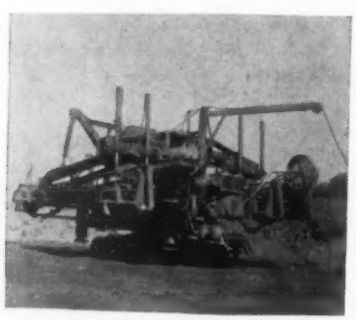
Trailer haulage was adopted by the Alston Coal Co., Pittsburg, Kan., in 1928, using United Iron Work dropbottom units. Large-scale haulage with trucks was even earlier, however, Pittsburg & Midway adopting this form of transportation at Moundville, Mo., in 1927.

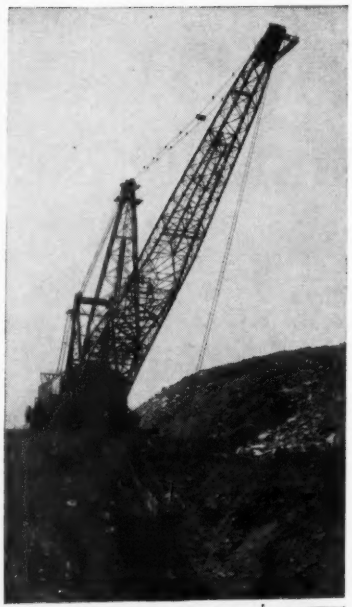
Sidewall Drills

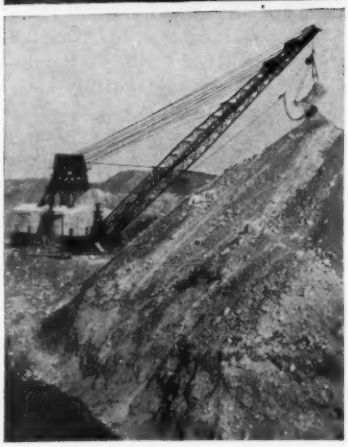
By 1930 enough machines of considerable size were in service so that nearly 5% of the bituminous output was achieved by this method. At that point it could be said that stripping was established and on its way. However, it had problems—and still does. One was drilling with the original churn-type equipment. Consideration of alternatives led W. H. Stewart, general superintendent of the Central Indiana Coal Co., and Mr. Sherwood to develop the sidewall drill. It became the ancestor of a wide variety of such units in the ensuing years.

The early 30s also saw, in the Middle West particularly, the start of wide use of small shovels and particularly the small dragline. Meanwhile big shovel size kept moving up with 16- and 20-yd machines prior to 1933. Redesign of dippers to increase the capacity of existing equipment also got very active starting at about that time. Late in 1933, for example, Pittsburg & Midway replaced a 16-yd cast dipper with a 20-yd all-welded unit, supplementing it with a counterbalance for the hoist. Bucyrus-Erie also, in 1935, supplied a counterbalance and an 18-yd all-welded "Man-Ten" dipper to a machine of the Pyramid Coal Corp., in Illinois.

A 30-yd "Man-Ten" dipper went on a new 950B machine for the Bobolink mine of the Binkley Mining Co., Seeleyville, Ind., in 1935. Earlier in 1935 however, a 32-yd aluminum unit had been applied to a 5560 shovel for Northern Illinois Coal Corp. It followed a 15-yd composite dipper (replacing a 12-yd unit) for the Commercial Fuel Co., Pittsburg, Kan., and a 16-yd aluminum-alloy unit for Northern Illinois in 1935, replacing a 12-yd steel dipper, both in 1935; and a 5-yd aluminum dipper on a loading shovel (3½ yd previously) at the Hume-Sinclair property, Tiger, Mo., in 1934.







Walking Draglines

Although, as previously noted, draglines were used nearly half a century ago in the Missionfield, birthplace of stripping, the shovel, because of its characteristics was the better tool as long as it fit the overburden. Up to around 1935, there was little need to go into overburden beyond the reach of a shovel—and even after, with some exceptions, as in the Brazil Block field of Indiana, distinguished by a highly saleable and high-priced but thin vein under heavy cover.

With these conditions confronting him, Hugh B. Lee Sr. took a hard look at the dragline, and in 1937 started a 12-yd Monighan electric walker in the Old Glory No. 17 pit of the Maumee Collieries Co. It was an unqualified success, and thus became the ancestor of all the succeeding walkers, including the 85-cu yd machine now being built.

Earlier, in 1935, the first of the 5561 "knee-action" shovels, originated by Marion, had gone to work, with a 35-cu yd dipper, at the Boonville (Ind.) operation of the Tecumseh Coal Corp. And about 1935 the scraper began to find widening use, first as an adjunct to shovels and draglines in box-cutting, peak

spreading and the like, and later as the sole stripping tool for thin overburden at the smaller mines.

Semi-trailer size in the mid-30s had moved up to 40 tons or so in some instances, where it tended to stay for quite a few years, even though Hume-Sinclair, at Tiger, Mo. put an 80-yd unit, Man-Ten steel, into service in 1938. The idea of combination hauls also was beginning to catch on. One of the earliest was in 1937 when Enos installed a special electric train at Oakland City, Ind., to haul from a field station. Later, when the diesel became available, it was used in a number of combination setups.

Stripping-shovel power by the end of the 30s was practically standard at 4,160 V, though older 2,300-V machines were still in service. Some work was being done with field cables instead of pole lines, though their use was never extensive. A substitute was being sought for the solid ground wire, almost universal before 1933, and it was found in the neutral grounding resistor normally limiting voltage from frame to ground to around 100 before tripping the breaker.

Reclamation

Tree planting was one of the earliest forms of reclamation of strip spoils, with one of the earliest to do so Mr. Sherwood on one of his Indiana properties near Linton. Organized planting was started by the Indiana operators around 1926.

The close of the 1930-40 era witnessed the start of another form of reclamation that very soon resulted in the cessation of dump sales of old spoils by making possible a quick and worthwhile return. In that year Byron Somers, superintendent of the Red Ember mine of Truax-Traer, Fiatt, Ill., developed the idea of seeding unlevelled spoil and pasturing cattle. His unqualified success at this, and at such other sidelines as raising gladioli, muskrats and bullfrogs, was quickly and widely emulated.

Outcrop Stripping

The rise of stripping with small units in the Middle West and elsewhere, including Ohio, had up to World War II roughly paralleled the rise of activity with the major units. But as the war wore on, the demand for coal rose, and the cessation of road construction and other normal contract work freed light equipment, there was an abrupt rise in the volume of outcrop stripping in the East and South from Pennsylvania to Alabama. The present active stripping industry in this area dates from those wartime beginnings.

Meantime, bigger machines in the oldline territory were being put into thicker material, aggravating the overburden-preparation problem and particularly the problem of drilling with either the newer horizontal or the old vertical churn units. The answer was to go to oil-well-type rotary equipment, which provided greatly increased speed and thus eased the cost of preparing the heavier overburdens. Possibly the first of these oilwell-type machines appeared in 1939.

Miscellaneous developments in the war years included such things as the first pinning machine for breaking coal for loading at the Seneca Coal & Coke Co., Catoosa, Okla.; electric heating to prevent cracking of cylindrical dipper sticks at the Fiatt (Ill.) mine of Truax-Traer; and the use of an 8-yd walking dragline by J. Robert Bazley in stripping for the St. Clair Coal Co., near Pottsville, Pa.

Very shortly, however, this 8-yd machine was eclipsed by installation of a 25-cu yd Bucyrus-Erie walker at the nearby Beechwood stripping —the first of the "big" units. It was about this time, near the end of the war, that anthracite began to go in for really deep pits with both draglines and, beyond their reach, hauling of spoil in diesel trucks with dump bodies. Elsewhere, dipper size on shovels had risen to 40 cu yd, and the modern unit substation, usually featuring grounded Y hookups, was finding increasing use.

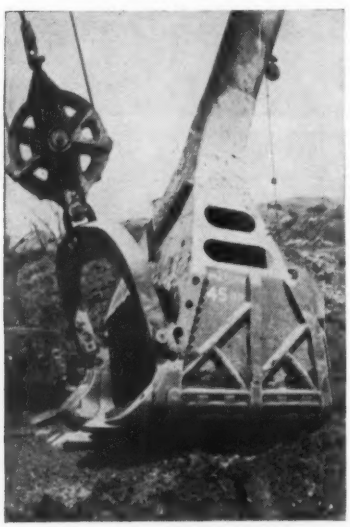
Maintenance and service was being facilitated by a growing array of lubricating, fueling and service trucks, plus mobile cranes. By this time also,

operators were embarking on the pooling of certain high-cost items common to the several identical machines in the area to cut cost of parts inventories while still having a spare close at hand.

Big Dippers

The Hanna Coal Co. accounted for two of the jumps into the era of really big dippers for shovels in the late 40s. It installed a 45-cu yd unit in 1948 on stripper built for 35 cu yd. The weight of the two dippers was the same. In 1949, it upped the yardage of another dipper to 49. Meanwhile, in 1947, the bucket size for draglines jumped to 30 cu yd.

The continuing search for equipment to promote efficiency also resulted in such developments as the use of F-M radio for communication (Sunlight Coal Co., Boonville, Ind., G. E. equipment), and the growing use of tractor-mounted and front-end loaders for coal loading and other pit services.



The auger came in in 1948, as recounted in the earlier review of continuous mining in this issue, and soon was seized upon for extending coal recovery beyond the last cut. Earlier, in 1947, at least one company was embarking on a different scheme—an early ancestor of "punch mining," or recovering coal panel by panel from successive openings in the last cut.

Some of the earliest examples of shooting of spoil—normally the first and second cuts on fairly steep hillsides—also were in the late 40s in stripping.

Dry Rotaries

Deeper and deeper overburden and more and more rock continued to give strip operators bigger and bigger headaches in the 40s, in turn stimulating more and more attention to drilling and shooting practices. In drilling particularly the growing height of banks and the need for breaking strata toward the top had stimulated development of two-level sidewall drills, the angling of holes in sidewall drilling, and the growing use of vertical rotaries and decking of charges.

The drill, its footage rate, and the problems involved in operating wet with the vertical units available to that time became more and more a critical item. The year 1950 brought a breakway from old vertical equipment—both churn and rotary—with the introduction of the dry-type vertical rotary. The joy "Heavyweight," first employed at Enos in Indiana, in 1950, signalled the start of the changeover. It employed the first of the Hughes Tri-Cone bits used in coal-strip drilling.

Hole size at Enos was 7⅞ in, but the demand for larger holes was growing more pressing for at least two reasons: fewer holes to cover a given area and space to concentrate charges to break thicker and harder burden more efficiently. In line with this, Maumee instigated the development of the Bucyrus-Erie 50-R machine and installed the first in 1952. It was designed to drill holes up to 12 in, but soon was putting down even larger.

The need for newer units providing the advantages of high-speed dry-hole drilling for use in outcrop and other service where portability was critical soon resulted in the development of a number of truck- and tractor-mounted machines—for example, a Davey truck unit for the Mays Coal Co., Clarion, Pa., in 1954; a Winter-Weiss Portadrill for Truax-Traer in southern West Virginia in 1956; and the Robbins tractor-mounted machine with quick-lowering mast at various Alabama properties, also in 1956.

Design refinements in drilling included, among other things, attempts to attain full completion of holes without adding drill-stem sections. An example was a Reich Bros. machine capable of drilling 50 ft with one stem, installed at a Venango County (Pa.) operation of the Tasa Coal Co., in 1956.

Other developments in the first half of the 50s included wider use of detonating fuse; the introduction of MS connectors in fuse lines at Indiana properties of Maumee to cut complaints about noise and vibration and improve efficiency; the development of the derived neutral ground for the protection of 440-V circuits; a start on levelling of spoil, in some instances to the extent of replacing the top soil to permit a return to row crops; the construction of the first overland belt in coal stripping at the Will Scarlet mine of the Stonefort Corp., Stonefort, Ill., in 1953; and the establishment, in January, 1955, of a new record (to that time) for shovels—2,057,438 cu yd by a 46-yd Hanna machine.

Ammonium Nitrate

The last half of the 1950-60 decade brought breakthrough in materials and machines in clusters rather than one by one. One such breakthrough was ammonium-nitrate shooting—developed by Robert L. Akre and Hugh B. Lee Sr., of Maumee, and patented in early 1955. AN use has since spread to

other mining and quarrying operations throughout the world—and even to underground metal mines.

Study and experimentation since 1955 have resulted in methods of adjusting speed and sensitivity within limits, and such adjustments now permit its use in holes down to 2 in in size. Improved packaging has facilitated use on a do-it-yourself basis, while pre-packaged mixes are provided by the explosives manufacturers.

Study of detonating practices and their effect on performance—and also noise—resulted in growing use of detonating fuse in strengths up to 175 and 200 grains, as well as the development of low-grain-count surface trunk lines to connect down lines and cut noise to unobjectionable levels, compared to full-strength lines all the way. Special initiators for AN charges were offered by many concerns in 1960 to replace the earlier high explosive charges.

The drill developments characterizing 1950-60 continued in the last half. In horizontal drilling a new Joy 398SB rotary dry-type machine, installed at Peabody's Victoria mine, Boonville, Ind., in 1956, included a single stem 60 ft long permitting boring a 9-in hole 48 ft deep without adding sections. Slightly into the 60s, Peabody also began using a twin-head Robbins sidewaller distinguished by mounting on a full-revolving base, at its Power mine, Montrose, Mo. For angling holes from the perpendicular in vertical drilling, Joy announced a machine—also on a full-revolving base, for putting down holes at up to 30 deg off the vertical. One objective is better hole positioning paralled to the face of the slope in the high banks now being excavated.

Installation of a mechanical tamping machine, developed by its own organzation, at Energy mine of Peabody, at Herrin, Ill., was a 1956 development. In 1958, the Atlas Jetloder was tried at several mines, bringing the blow charging of AN and stemming to coal stripping. Along with these developments bulk-handling systems for AN found wider and wider use, along with a rise also in prepackaged AN.

Ripping, long a method of preparing burden for scraper handling, got a new lease on life as a result of advances in ripper design—and also moved in to displace drilling and shooting to prepare coal for loading with installations in Pennsylvania, Illinois, Kentucky and Missouri in 1957. To facilitate decisions as to whether to rip or use other methods of preparing burden, Caterpillar Tractor, in 1959, offered an inexpensive seismic technique to determine the degree of rippability.

Super Shovels

Regular production use of the Marion 5760 shovel with 60-cu yd dipper, developed in conjunction with the Hanna organization and christened the "Mountaineer," marked the start of the "super" excavator era in coal stripping. It also marked the first use of the computer in arriving at the most efficient design, as well as a jump in operating voltage from 4,160 to 7,200. It was designed to handle banks up to 110 ft.

Bucyrus-Erie came up with the 55-yd "River Queen," which went into operation at Greenville, Ky., in 1957, but later that year "Big Paul"—a 5760 with 70-yd dipper, for River King mine of Peabody, at Freeburg, Ill., eclipsed both her and "Mountaineer." By that time also, dragline buckets had gone up to 35 cu yd.

And in 1959 and 1960 Peabody announced the letting of contracts for the Bucyrus-Erie 3850-B shovel with 115-yd dipper and the Marion Type 8800 85-yd walking dragline, to go into operation in the early 60s.

In power supply, the last half of the 50s was marked by increased use of unit substations using 3-phase transformers, and also wider employment of looping or paralleling, initiated at Gibraltar's Central City (Ky.) operation in 1956. One advantage is keeping down the size of individual substations, as well as the number of moves. Systems for checking ground-wire continuity also began to find favor in this period, which also saw first use of "solid-state" or "static" methods of regulating operating voltage as a substitute for previous rotating apparatus.

Wheel Excavators

Supplementing the shovel with another unit or units to increase its capacity and range in the same or thicker burden is an old practice in stripping. Tandem operation, combining a dragline with the shovel was

a method already in considerable use in the 30s and earlier. Other equipment that still finds major use is the bulldozer and scraper. Tower machines are another type that has been called upon.

The successful design of a machine now finding increasing use was completed in 1954 after 10 yr of experiment and test. It was the Kolbe wheel excavator, now being handled by Bucyrus-Erie. The majority of the work was done at Cuba (Ill.) mine of the United Electric Coal Cos., where the first commercial machine went into service.

A wheel built by Bucyrus-Erie subsequently went into operation at the Fiatt (Ill.) mine of Truax-Traer. It was followed, in 1959, by the fourth Kolbe machine, also at Cuba mine, which at that time was averaging 2,000,000 cu yd per month, making it, though a specialized unit, a stripper capable of really handling material.

What's Ahead in Stripping?

A part of the picture of future stripping already is visible in the shapes of the 115-cu yd shovel, 85-yd dragline and stripping wheel. An immediate question is whether these will remain the predominate types in, say, the next 10 yr.

One possibility, which probably should be considered remote at this time, is a stripper that could bore or cut its way through any type of burden without shooting. If ever perfected it quite likely will require additional advances in metallurgy to produce the bits and other necessary components.

The idea of the stacker-shovel combination has intrigued strip-mining men for many years. A substantial cut in the size and cost of the shovel is one benefit. But successful stacker operation requires that the rock be broken up fine—in turn generating an excessive cost if present methods are employed.

Deep-Mine Challenge?

Considering everything, it appears that shovels, draglines, wheels and the other equipment now handling stripping will be handling it in large part in the future—up to, say, 1970, and if the past trend continues. Two things that might alter this outlook is a breakthrough in underground techniques and exhaustion of strippable acreage. This means, among other things, acreage under practicable cover.

The upper limit of cover has not yet been reached, while the performance of the big machines able to work in such cover is still the same in terms of work done per unit of weight. In fact, in the case of the new draglines, it seems to be improving. However, there is an ultimate in cost of moving a yard of overburden and when that time comes and the yards become too numerous, deep mining will gain ground. This, however, cannot be viewed as something for the near future.

As to whether deep mining can ever take over, a look at the difference in tons per man (see chart) shows stripping doing very well up to now—except in one possible direction. This is auger mining, which is one form of underground production. It is far ahead in bituminous, with 31.36 tpm in 1960, compared to 22.93 for stripping and 10.64 for deep mining. Since 1955, the auger figure has been literally scooting up.

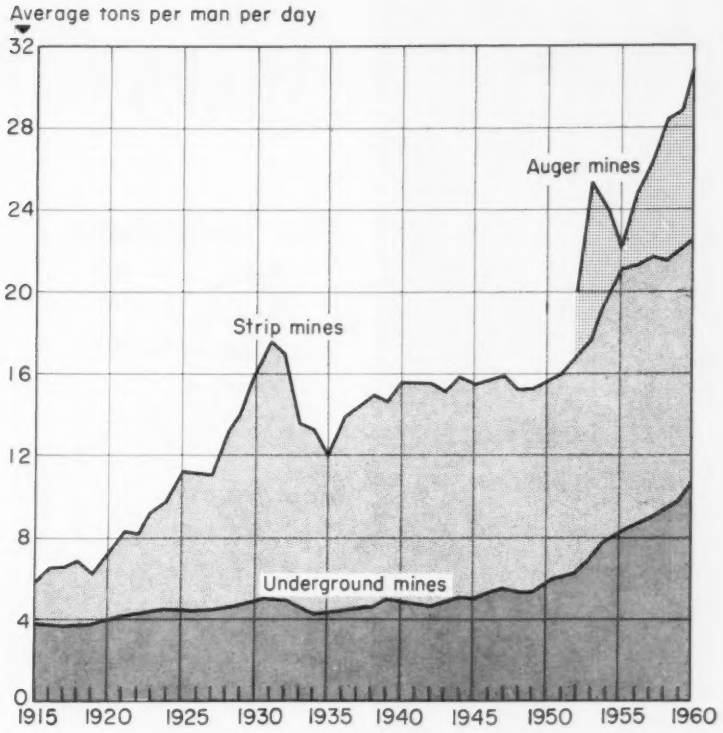
Perhaps the comparison at the moment is quite a distance from being fair, but there is little question that the auger gets coal with low manpower, even after weight is given to a lower percentage for preparation and service labor. If the principle could be expanded so that the drilling range was not 100 to 200 ft, but over 1,000 or 2,000 instead, and if this advantage could be mantained when the unit was taken underground, then stripping possibly could look for real competition.

The present remotely controlled, or robot miner now undergoing test by Joy and Peabody, represents such an extension of principle. It undoubtedly will find extensive use. Time will tell whether it can challenge stripping across the boards—or if some modification of machines and methods now used underground can do it.

Tomorrow's Practice

The differential over conventional underground methods in favor of stripping is substantial and represents a major hurdle. This may also be true for the robot unit when it goes underground and becomes subject to the inherent handicaps of deep operation. And neither the machine able to dig hard rock by itself nor the stacker seems likely to be employed to any extent in the relatively near future. Consequently, as previously noted, the shovel, the dragline, the wheel and the other supplementary equipment now being employed will still be handling the majority of the stripping in the future, with robot miners taking over in the last cut.

Stripper Size—One manufacturer at least—and quite likely more—is already prepared to take an order for a 150-cu yd shovel—and presumably a 120- or 125-yd dragline. These or even larger machines undoubtedly will find service in the next few years. They will require



THE TONS-PER-MAN PICTURE in strip, deep and auger mining. Stripping has maintained its differential and in fact has increased it slightly in the past several years. Productivity in auger mining is gaining rapidly on both.

tracts of probably 50 million tons, but these are available.

Because of their size and capacity, controls will be simplified to eliminate as much as possible the differences in operator skill. A single "stick," backed up by a complex electronic system to automatically control excavator motion, will be the system of the future—if control isn't reduced to a few buttons. Lighting will become more important, as will means of automatically determining dipper filling.

Overburden Preparation — Since there seems little likelihood that drilling and shooting can be eliminated in the next several years, they will continue to be key items. In fact, one of the reasons why stripping has been able to maintain and improve its position in the last 10 yr has been, in addition to larger and better excavators, the truly major advances in drills and breaking mediums. Some of the trends of the future include:

Tilting-mast vertical drills on revolving bases for angling of holes when desired will find significant use. Double masts may be employed, matching the dual-head sidewall machine already in service. For major operations drilling units may also incorporate facilities for charging of holes—possibly by simple pushbutton. For the sidewall unit, charging facilities also would be supplemented by a tamping or stemming unit.

More slurry-type blasting agents will be employed, while bulk-handling of the regular AN type will expand.

Contract overburden preparation by outside specialists will increase—perhaps to a significant percentage of the total.

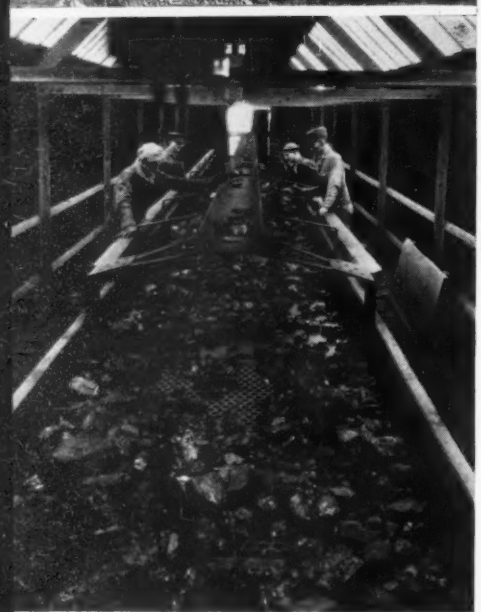
Ripping as a means of preparing overburden will increase as the size and power of tractors is upped and ripper design is improved still more.

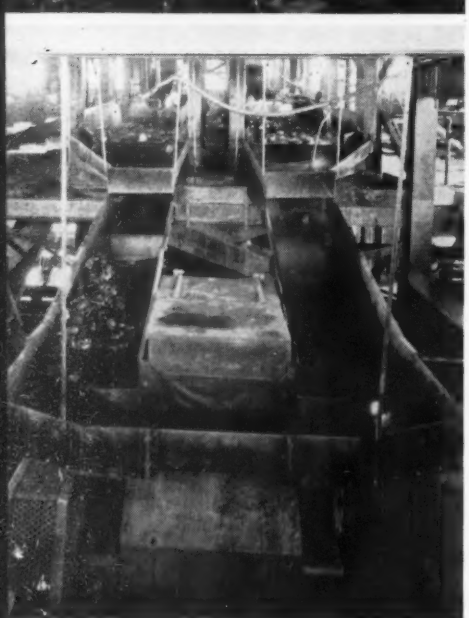
Haulage — The 100-ton haulage unit is already here and the 200-tonner is already being thought about and perhaps worked on. A carrier of this size poses problems of turning and maneuvering in pits of normal width. So, though super trailers might be employed in a one-way-movement system using ramps at intervals, the big machine of the future might be equipped with cabs at both ends, or the tractor and trailer might be designed so that the tractor could be detached, driven around and hooked up again at the opposite end.

The standard truck and the smaller tractor-trailer units will still have their place, but it is expected that the electric wheel will find wide application for both the conventional and the super units.

Combination systems employing rail cars or belts probably will increase in number to permit using automotive units in smaller sizes over shorter distances, while permitting a longer main haul to the plant at the most-economical cost. With a belt, the field might be divided into squares, with the belt being extended into each square as needed. And a new belt line to the next square could be set up at the proper time to be ready upon completion of the preceding square.

Power—Because of the increase in size and horsepower of excavators, voltage will go to 13,000 with the next stepup in rating. The trend toward packaged substations will continue, and also the trend toward keeping size within limits and providing other advantages by looping to feed from at least two directions.





Building Coal Quality

The Early Days . . .

Picking
Breaking
Screening
Washing

AGRICOLA, in "De Re Metallica," described the use of hand screens and jigs in 1556, which means that the principles of preparation go far back in time. Coal preparation in the U. S. got its start in the anthracite region. After Judge Fell, in 1808, demonstrated the practicability of burning coal in an open grate, preparation for a time consisted of picking out the biggest lumps in the mine. About 1830, lumps were brought to the surface and broken up, the fines being discarded. About the same time hand rakes with openings of about 1¾ in were employed in the mines—perhaps until about 1869, when it was found possible to use the pea size of hard coal.

Possibly the first anthracite breaker, incorporating breaking rolls and revolving screens, was erected by Gideon Bast, near Minersville, Pa., in 1844. Shaker-screen development started about 1890. Previously, in 1873, the Bradford breaker had been patented, and it began to find use in bituminous also in 1891.

Since stoves, grates and hand-fired boilers operated on a diet of coarse coal, and could not use fines, these fines also were rejected in bituminous mining in the early days. Forks, rakes and pans, the hand screen, and the "grill," or bar screen, all were employed to eliminate the fines before the coarse coal was loaded.

Hand picking at the face was of course the earliest form of impurity removal, and the practice was continued when preparation was moved to the surface. First use of the picking table was in the anthracite region—at the Hill & Harris colliery, Mahanoy City, about 1870. Anthracite probably also led in the introduction of mechanical cleaning into the U. S. Crude jigs were tested near Pottsville between 1860 and '65, and a few washeries were operating before 1870. Patents for another form of mechanical cleaner—mechanical pickers—had been issued as early as 1875. About 1890 they began to be used in some numbers in the hard-coal area.

In the bituminous region, the first bituminous washer, using a piston jig, was erected at Alpsville, near Pittsburgh, in 1869 to clean slack for coking. A sluice washer was installed by the St. Bernard Coal Co. in west Kentucky in 1882, where, in 1881, a model of the Campbell bumping table was tried. Other pre-1910 bituminous developments included:

Luhrig jig, Sloss-Sheffield Steel & Iron Co., Alabama, 1890.

Tub washer, Wilmington Washed Coal Co., Illinois, 1891.

Robinson washer, T.C.I., Alabama, 1892.

Stewart jig, Big Muddy Coal & Iron Co., Illinois.

Scaife trough washer, Maltby Coal Co., Illinois, 1898.

Elmore plunger jig, 1900.

American jig, Illinois, 1904.

New Century jig, Illinois, 1906.

Wilfley table, Stag Canon Fuel Co., New Mexico, 1906.

Shannon jig, Illinois, 1907.

Foust and Pittsburgh jigs, 1909.

Montgomery jig, 1910.

As the preponderance of washers installed in Illinois indicates, it was the leading state in this department in the years immediately before 1910.

1910-20 . . .

Washing Comeback
Air Cleaning

As the 1910-20 decade opened, both anthracite and bituminous relied largely on hand-picking (preceded by breaking in anthracite) and screening. Some washing had been done in both industries but the tonnage handled was small, even though, as previously indicated, the list of washers was long. In fact, the

Through the Years

percentage of bituminous mechanically cleaned continued until almost the end of the decade a decline that started in 1915.

But though mechanical cleaning was re-born in the 1910-20 era the activity was on the modest side. The Deister-Overstrom "Diagonal Deck," Butchart, Plat-O and Overstrom tables were tried out in the Stag Canon plant in 1916 and '17, but other than that there was not too much activity in wet-cleaning units. Experiments with flotation were undertaken at Mellon Institute in 1918.

The big event of this era was the final introduction of air cleaning, on which patents had been granted as early as 1850. The first unit was the American pneumatic separator, developed from the Sutton, Steele & Steel separator used in cleaning seeds. The first installation was at the McAlester-Edwards mine, McAlester, Okla., in 1918, and the first commercial installation at Raton, N. M., for the St. Louis, Rocky Mountain & Pacific Co., in 1919.

Screening developments in the 1910-20 period included introduction of the flexible-arm shaker from anthracite for fine-coal sizing; introduction of the Marcus screen-and-picking table combination from England in 1912; use of the Krehbiel horizontal and "Anti-Gravity" screens before 1915; and development of the Peterson pendulum screen in 1916.

Electric drives for vibrating screens came in the latter part of the decade. One employed a motor, in this instance with unbalanced weights and the other, developed at Steelton, Pa., in 1919, was of the electromagnetically operated type. Both types still are widely employed.

1920-30 . . .

Sand Flotation
Launder Washers
Upward-Current Machines
Baum-Type Jigs
Heat Drying
Centrifugal Drying
Filtering
Vibrating-Screen Acceleration

Growing installation of burning equipment that could use the lower-cost finer sizes, with resultant emphasis on minimum impurity content and maximum uniformity (all also very important to the growing steel industry), are among the reasons why coal came back to washing after dropping it almost completely in the 1910-20 era. The number of new washer designs picked up, and along with it the tonnage of coal handled. The list of new machines in this decade includes many that still are finding service today:

1921—First Chance sand-flotation equipment, at Staples & Bell Colliery, W. Nanticoke, Pa.

1923—Peale-Davis "Pneumo-Gravity" air separator introduced — no longer used.

1924 — Rheolaveur process introduced from Europe—Baltimore Colliery, Hudson Coal Co., Scranton, Pa.

1924—Menzies hydroseparator offered.

1925—Hydrotator offered.

1925 — First bituminous Rheolaveur plant, Cokedale, Colo.; first bituminous Chance installation, Mt. Union, Pa.

1926—Sludge flotation, Snoqualmie, Wash.

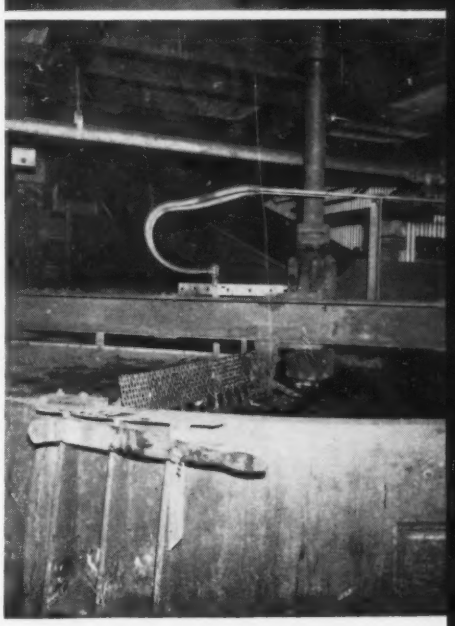
1926—First Menzies hydroseparator installations in bituminous.

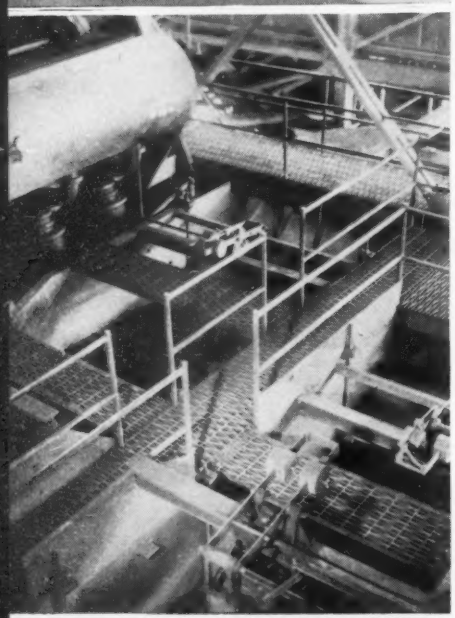
1928—First Baum-jig installation—Link Belt-Simon Carves — Pittsburgh (Pa.) plant, Jones & Laughlin Steel Co., and Allendale No. 2 mine, Central Indiana Coal Co.

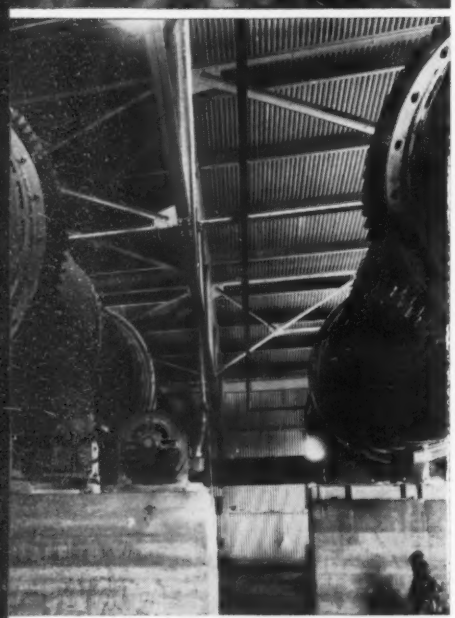
1928 — Arzinger flotation process, Alabama and anthracite.

1930—Air-sand process installed at Cadogan (Pa.) plant, Allegheny River Mining Co.

An increase in the top size of coal handled in washers also character-







ized this period. Instead of the previous 2½ or 3 in, the upper limit was raised in many installations to 6 or 7 in.

With the increased use of washers interest in drying was stimulated in the bituminous field, though anthracite stuck to shipping wet, which is still the practice. The emphasis was on centrifugal and rotary-kiln-type equipment. The centrifugals included the Wendell, developed in Illinois about 1914; the American or Elmore, Steelton, Pa., about 1914 also; and the Carpenter, about 1920, with the first installation in 1924.

Filters also began to come into the picture because, even in those days, black water in streams was beginning to cause objections. The Pittsburgh Coal Co., for example, installed Laughlin filters in 1928 and Dorr and Genter equipment in 1930.

Heat-drying units were, as noted, of the rotary-kiln type, including the Christie, installed by Pittsburgh Coal and Buckeye Coal in 1930. Some 10 yr earlier, Ruggles-Cole machines were being used by the Cottonwood (Mont.) Coal Co.

Vibrating screen use picked up markedly around 1925 for fine coal, dedusting and the like.

Handling coal had created complaints about dust from the start of mining. Water was the major alleviating medium up to 1926, when three operators in the low-volatile field of West Virginia started the dustless-treatment movement with calcium chloride.

1930-40 . . .

Chloride Washers
Retreatment
Raw-coal Blending
Stoker Preparation
Dustproofing
Cascade Dryers
Screen Dryers
Flash Dryers

Though the early 30s were the years of deepest depression, mechanical cleaning of coal in the bituminous field began to get up and go. Anthracite by that time was on a practically 100% basis. Along with greater customer stress on quality and uniformity, many coal companies also began to appreciate the possible sales advantages of being able to offer washed coal, which then was a glamourous product.

The number of units employing heavy mediums increased in the 1930-40 era. Chance earlier had come out, as previously noted, with the sand-flotation process, and also in 1921 the Hudson Coal Co., Scranton, had experimented with the Conklin process, employing magnetite, with a Dorr thickener for its recovery and recirculation.

In 1932 an experimental Wuensch "Differential Density" washer, using impurities in the coal to generate the medium, went into service at the W. Mineral (Kan.) plant of Pittsburg & Midway, followed by a commercial unit in 1933. And in 1935 the Fuel Process Co's. calcium-chloride washer was installed at a number of properties. In 1939, a heavy-liquid unit, based on du Pont development, was used at the Weston breaker in the anthracite region. Except for Chance, however, there was no volume of heavy medium in this decade.

Washers introduced in the 1930-40 period included the Jeffrey diaphragm, contracted for by Amigo Coal Co., Amigo, W. Va., and Pruden Coal & Coke Co., Pruden, Tenn., in 1935, followed in 1936 by a contract for a Jeffrey Baum-type unit for Raleigh Coal & Coke Co., Raleigh, W. Va.; the Vissac, imported from Canada and installed by Northwestern Improvement in Washington and Snow Hill in Indiana, 1935; the Link-Belt combination launder-jig washer, 1937, with a trough washer (Ayrdale mine, Maumee, in Indiana), 1939; Koppers-Battelle launder, Nellis, W. Va., 1937; probably first self-contained or unit washery, Jeffrey, Raven Red Ash Coal Co., Raven, Va., 1937.

Denver flotation equipment was installed at W. Mineral, Kan., by Pittsburg & Midway in 1934, followed by 12 machines by the Pitts-

burgh Coal Co., in western Pennsylvania. The first of the "modernistic" plants (McNally Pittsburg) was put in operation by the Sentry Coal Co., Madisonville, Ky., in 1937. About that time, or shortly before, the practice of retreating middlings and in some instances cleaner refuse began to catch on.

Blending in big multicompartment plants before washing also was a development of the middle 30s, two of the first plants being at Isabella mine of Weirton Coal and Mather mine of Mather Collieries, in western Pennsylvania. By this time, also, the demand for top-sized lump had dropped to the point where it was being eliminated from some flowsheets by breaking it down and, to a growing extent, washing it with the other coal.

The rise of the stoker—domestic and commercial — brought about a major increase in dedusting on screens and in aspirating-type equipment. As the demand continued to grow, more crsuhing was done to provide stoker and multi-bin "prescription" plants, some providing for accurate percentage blending of various size fractions by variable-speed feeders, became more frequent. Dustless treatment of stoker as well as coarse sizes became almost a must in the last half of the 30s, with oil of 200- or 300-sec viscosity the preferred medium. For some very porous coals, paraffins and waxes up to 3,000 sec or more were employed.

Several new types of heat dryers were developed in the 1930-40 decade. They were, in approximate chronological order: the D-L-O, installed by the Central Indiana Coal Co. in 1931; the Bixby, Midland Electric, Farmington, Ill., 1933, an early form of the cascade type; the Vissac dryer (McNally Pittsburg), the latter at a Northwestern Improvement Co. plant in Washington in 1936; screen-type dryer, of a type developed by Island Creek, Buckheart mine of United Electric, Canton, Ill., in 1937; introduction of the Link-Belt Roto-Louvre dryer and inauguration of flash drying with Raymond equipment at the Enos plant, in Indiana, in 1938.

In the field of refuse disposal, possibly the first example of pumping, using Allen-Sherman-Hoff Hydroseal equipment, was at the Amherstdale (W. Va.) plant, Amherst Coal Co., in 1937. Truck refuse disposal also began to displace other forms at an accelerated pace late in the 30s.

1940-50 . . .

Heavy Medium
Tabling
Anthracite Flotation
Centrifuging
Mechanical Filtering
Cyclones

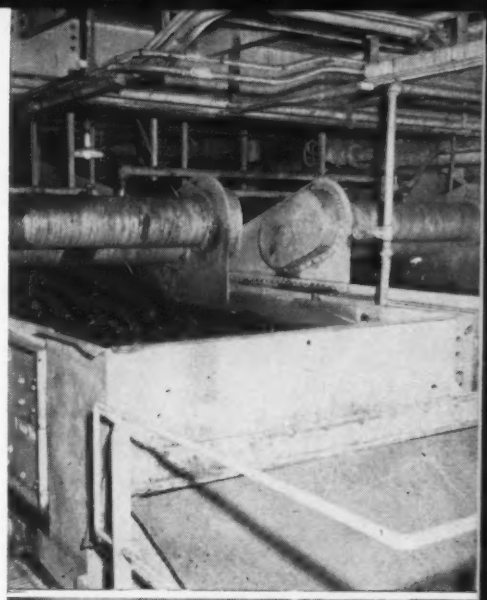
The advent of magnetite medium, plus the onrush of tabling and the accelerated growth of flotation, were high spots of the 1940-50 decade, along with mechanical dewatering of various types, including cycloning.

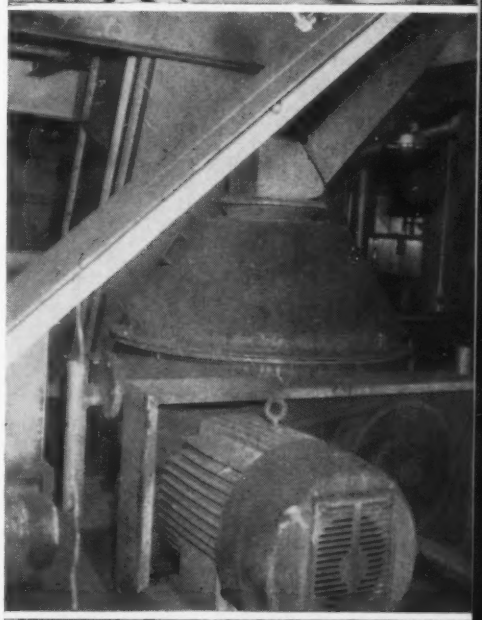
Early experiments with magnetite as a densifying medium go back to the Conklin machine which, as previously noted, Hudson Coal tested in 1921, at Scranton, Pa. American Cyanamid, however, after appointment as technical representatives and sales agent for the patent-holding group, got the idea off the ground in the 40s. The first commercial installation of a separator using magnetite (by Link-Belt) was for retreating middlings at the Champion (Pa.) plant of Pittsburgh Coal, in 1945. The first anthracite installation was in 1949 at the Park City plant of Rhoads Contracting Co. Other machines brought out through 1950 included:

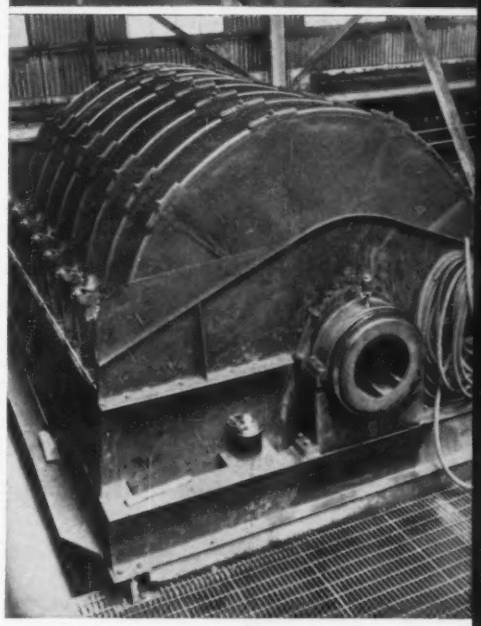
1948—Wemco "Mobil Mill" equipment, installed at several anthracite and bituminous properties in that year, and later supplemented by other larger-capacity machines, including multidensity types.

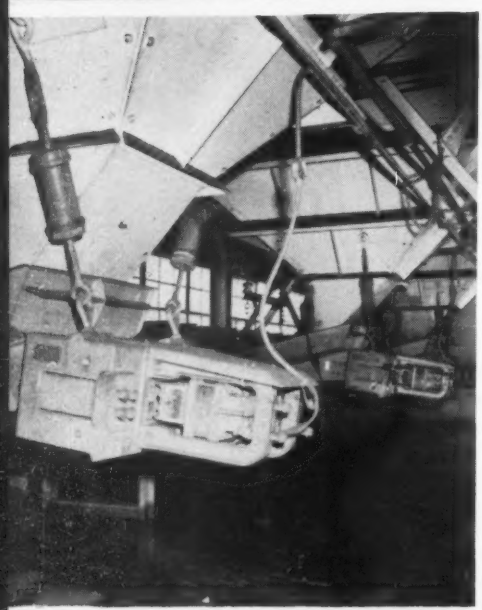
1949—Neldco equipment, Youngstown Mines Corp., Dehue, W. Va.

1950 — McNally-Tromp, Old Ben Coal Corp., Valier, Ill.; Akins classifier machine, Crystal Block, Rawl, W. Va.; packaged Neldco machine for Saginaw Dock & Terminal, eastern Ohio.









It will be noted that the majority of these early machines went to metallurgical mines where the greater precision of separation was especially desirable. Meantime, new washers using water only included the ORC Harz-type jig for recleaning, 1940; the McNally-Rheo fine-coal launder, 1943; the ORC jig, 1944; and the McNally Mogul, plus an air cleaner—the McNally Brusset vacuum jig, 1949.

Though coal-washing tables were first tried with bituminous coal, they did not really begin to catch on in bituminous—or anthracite—until the 1940-50 period. The year 1947 possibly was the pivotal year in bituminous, with contracts for multitable plants at Piney Fork (Ohio), Hanna Coal Co.; Consol of Ky., Jenkins; and Rochester & Pittsburgh, Homer City, Pa. The usual sizes treated were much the same as now—¼ or $\frac{3}{16}$ x 0.

The increasing importance of fine coal, plus the need for processing to eliminate stream pollution, were major reasons for the growing prominence of tabling, and also for the acceleration of flotation at about the same time. Anthracite perhaps took the lead in adopting flotation—usually to process silt for power-plant use. In 1947, for example, a Steffenson-cell plant for 28M silt went into operation for Susquehanna Collieries at Nanticoke, Pa. Earlier, a pilot plant at Tamaqua, Pa., set up by Lehigh Navigation in 1942, resulted in a full-scale operation with Denver cells in 1945. Wilmot, in 1949, installed the first of its Hydrotator-classifier units modified for flotation at the Colitz Coal Co. property.

Several other plants—usually substantial in size—went into anthracite in subsequent years.

The growing output of fine coal from washeries in the 1940-50 period presented a problem not only in heat-dryer operation, but also brought on the relatively new one of how to handle the ultrafines. Mechanical unloading of water ahead of heat dryers or as an alternative complete mechanical dewatering, were fundamental cost-cutting approaches. Thus, the 50s can be marked as the era in which coal really got into mechanical dewatering with equipment other than screens, as well as new types of screens themselves.

One result of this changing emphasis was the introduction of new centrifuges, such as the C-M-I in the early part of the 40s; Bird filters and later polishers around 1945 and later, with early filter installations by Island Creek, Delbarton, W. Va., and Consol of Ky. in 1947; and consideration of cyclones for thickening for final discharge or in advance of other units starting in 1945. The Dutch State Mines unit was the first of the cyclones, rights later obtained by Heyl & Patterson. Possibly the earliest use of the cyclone for cleaning up water—in this instance ahead of filter equipment—was at the Ceredo (W. Va.) central plant of Truax-Traer.

Heat drying in the 40s was marked, among other things, by development of the "Verti-Vane" cascade-type dryer by R. G. Baughman, preparation engineer for the Central Indiana Coal Co. The first commercial installation (Holmes Bros.) was in Central Indiana's Maid Marian plant at Odon, Ind., started up in 1948.

In the field of screening, stainless-steel, though it had found use for this and other purposes earlier, began to be called upon in some volume to increase screen life, particularly screens for the finer sizer, in the early 40s. Wedge-wire and bar use also began to rise at about the same time.

1950-60 . . .

Heavy-Medium Cyclone
Fine-Coal Jigs
Double-Deck Tables
Bituminous Flotation
Fluid-Bed Drying
Filtering
Fixed-Screen Dewatering
Gamma-Ray Controls
New Air Equipment
Automated Loading

Acceleration of the use of heavy medium was one major mark of the 1950-60 period in coal preparation. Dual-density separators were developed and the cyclone charged with magnetite was brought into the cleaning picture. The list of heavy-medium units offered included the following:

1951—Roller "Dual Density."

1952—Wemco dual-gravity, Beaver Brook Coal, anthracite region; Wilmot-Daniels, Hellier Coal & Coke Co., Hellier, Ky.

1953 — Daniels DMS, Crichton Coal & Coke Co. and Nugent Mining Co., Pennsylvania; Wilmot HM, Clearfield Bituminous Coal Corp., and Gilberton Coal Co., Pennsylvania bituminous and anthracite.

1954—Dutch State Mines (Roberts & Schaefer), Freeman Coal Mining Co., Waltonville, Ill.

1955—Wilmot OCC, Crichton Coal & Coke and Beaver Brook, Live Oak, Pickens and Tunnel Ridge, in anthracite.

1957—M series, Fuel Process, contracted for by Amigo Smokeless, Crozer, Galloway Land Co. and Panther Coal, in West Virginia; Irvin-McKelvy, Wingert Contracting Co., Pennsylvania.

1958—Menzies, Reidinger, D & Z and Apex, in anthracite; Roller, Glosser and Pais Pocohontas.

1961 — Norton, by Nortons-Tividale, Ltd.

The first cyclones charged with magnetite to convert them into cleaners were installed by Roberts & Schaefer in plants of the Bethlehem Mines Corp. and the Island Creek Coal Co. starting in 1960.

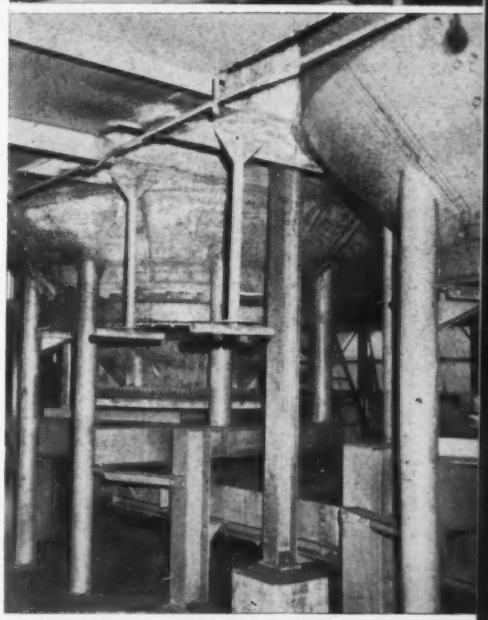
New wet-cleaning units introduced in the 50s included the McNally Mogul and McNally Giant. Special jigs for fine-coal cleaning included the Citron-OCC, now handled by Heyl & Patterson, developed by Elmer Citron, preparation engineer, Pittsburg & Midway, and first installed at No. 19 mine, Kansas, in 1955, and next at DeKoven, Ky., in 1957; and the McNally feldspar, Badger Coal Co., Philippi, W. Va., 1957.

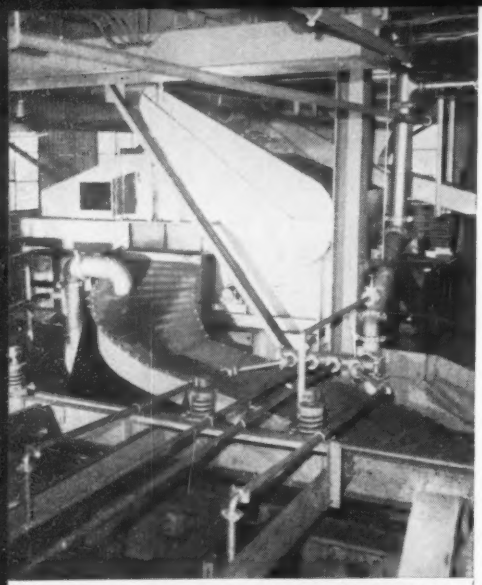
In the fine-coal field also, after development at Consol operations, the Concenco "77" double-deck washing table was the subject of contracts by American Coal, Eastern Gas & Fuel, Hanna, Harlan Fuel, Island Creek, Jamison, Jewell Ridge, Mrak (Alaska), Peerless Coal & Coke, Pocohontas Fuel, Russell Fork, U. S. Pipe & Foundry, U. S. Steel and Weyanoke. This list reflects the appeal of the increased capacity in the same floor space, along with other improvements.

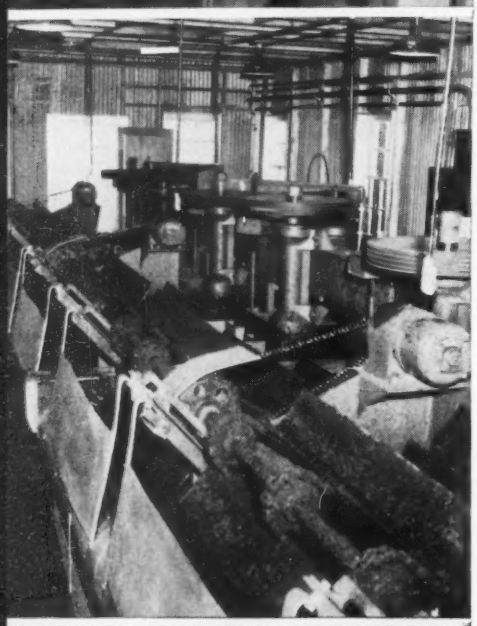
Though some machines had been used in earlier years in regular production, flotation became really established in bituminous in the 1950-60 era. Goals were reclamation of fines and assistance in the water cleanup problem. Recently, the flotation unit is being suggested as a means of simplifying the circuit, thereby cutting investment and operating costs where water cleanup is the only goal.

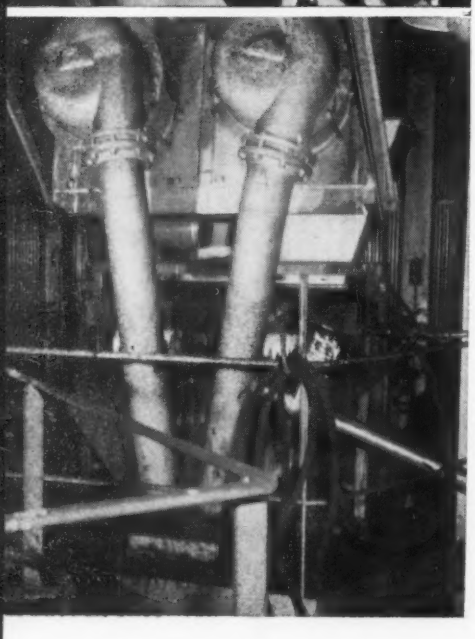
In addition to the Denver equipment already in the field, Wemco Fagergren units made their bow in 1958 with contracts by the Central Appalachian Coal Co., Hanna, Pocohontas Fuel Co., and Rochester & Pittsburgh, all in West Virginia. The Heyl & Patterson froth-flotation unit was selected by R. & P. for use at Homer City, Pa., in 1960. Anthracite installations included Agitair plants for Centralia Mining and Jeddo-Highland in 1953.

First of the fluid-bed dryers was the Dorrco "FluoSolids" unit—installed in 1955 at the Lynnville (Ind.) plant of the Lynville Coal Co., to handle coal from Bird filters. It precipitated a stampede to this type of equipment, which now far outsells other types for the finer sizes. However, development and installation of other types proceeded up to the advent of the fluid-bed machine. McNally Pittsburg, for example, offered the McNally-Pulso machine, first installed by Northwestern Improvement, in Washington, in 1950. In that same year, Youghiogheny & Ohio contracted for an H & P thermal unit for installation at Glen Robbins, W. Va. And in 1959 a packaged rotary-kiln machine—the Ruby—went into service









at Dola, W. Va., for Robey Run.

In addition to the Dorrco, the list of fluid-bed machines introduced in the late 50s and early 60s includes:

1958 – Parry entrainment dryer, Orient No. 3 mine, Freeman, Waltonville, Ill.

1958–H & P, Jewell Ridge Coal Co., Virginia, and Rochester & Pittsburgh, West Virginia.

1959–Tailor "Stream Flo," Fairmont Machinery.

1959 – Link-Belt "Fluid Flo," in service at Enos, in Indiana, and elsewhere.

1961–McNally "Flowdryer."

Mechanical dewatering equipment continued to find increased use in the 50s, with a number of new machines being introduced, including the Reineveld, with early users in 1953 being Russell Fork, in Kentucky, and William Aloe, Imperial, Pa.; and the Wemco Siebtechnik, offered in 1961.

One machine incorporating oscillation of the basket was introduced from abroad – the Bird-Humboldt, Compass Coal, West Virginia, 1957.

The major increase in water-handling and clarification circuits in the 1950-60 era resulted in increased employment not only of cyclones thickeners and the like, but a substantial increase in the use of vacuum filters. Types and early installations included:

1951 – Petersen filters in slurry-reclamation plant of Bell & Zoller, Johnston City, Ill., plus TFR machines for Jamison, West Virginia, and Youghiogheny & Ohio, Ohio and West Virginia.

1952–Eimco, Kaiser Steel, Sunnyside, Utah and Wheeling Steel, Harmarsville, Pa.

1955–American, Columbia-Southern, Midvale, Ohio.

1958–Eimco Agidisc, Moss No. 3, Clinchfield, in Virginia.

1958 – Oliver horizontal, Island Creek; Denver, Pocohontas Fuel, both in West Virginia.

The search for some means of taking at least part of the load off moving or rotating dewatering equipment, and thus reducing investment operating and maintenance costs, led to the introduction of two fixed dewaterers from abroad. First was the Hein-Lehman (Nolan) radial screen, incorporated in the U. S. Steel plant at Corbin, Ky., in 1955, along with bowl-type Dorrco desiltors. The second was the Sieve Bend (Heyl & Patterson), first contracted for in 1959 by Amherst Fuel, Semet Solvay and Valley Camp, West Virginia, and Carpentertown Coal & Coke., Pennsylvania.

With the growing use of magnetite as a medium came growing concern with sharp control over bath density to prevent erratic results. This led, among other ideas, to the development of controls incorporating gamma-ray generators. Perhaps the first use of such equipment, in 1951, was in controlling the penetration of the cutter on a dredge reclaiming slurry for flotation treatment at Fidelity mine of United Electric, Duquoin, Ill. Gagetron equipment on the slurry line permitted checking on variations in slurry density, in turn permitting proper variation in cutter penetration.

Equipment for control of bath density began to find application a little over 2 yr ago. The AccuRay system, for example, went into Moss No. 3, Clinchfield Coal, in Virginia, in 1958, and was followed by another installation in a system worked out by Wilmot for its Wilmot-OCC machine at the plant of Underkoffer Coal Service, in anthracite, in 1959. Also in 1959 and also in anthracite, Ohmart apparatus was adopted by the Locust Valley Coal Co.

The ranks of the air cleaners were swelled by the addition of the Ridge Airjig, a self-contained packaged unit introduced in 1960, in which year contracts were signed by Crystal Block, Driscoll, Hyasota, Larsen, Leader, New Shawmut, Rice Bros., Rich Hill, Sandy Run and Valley Coal. Earlier in the decade, the problem of ironing out variations in moisture with units then employed was tackled by predrying in thermal plants, which also eliminated the excessive moisture normally resulting from the increased use of water to allay dust at the face.

Although the reduction in number of sizes shipped from upwards of 50 or 60 at some operations in the 30s, and 10 to 15 at most, to half

a dozen or less, with lump almost never included, at most plants today simplified the loading problem, it still left it as a time- and labor-consuming chore. Automating it employed at least two approaches in the 50s. The first was the use of the overhead shuttle conveyor or tripper, with the first major shuttle installation for 28 cars without shifting at Robey Run, Dola, W. Va. A neighboring operation, Compass, put in a triple-belt shuttle system for 60 cars in 1957.

A travelling tripper with sensing devices to move it automatically from car to car and shut it off was another type of automatic belt system developed by McNally Pittsburg for the Thunderbird mine in Indiana. The system will load cars in order on both sides of the overhead structure, or will actually hunt up and down until every car is loaded before it shuts off.

Automatic or semiautomatic systems still retaining the idea of moving the cars on the regular tracks included the car hauls installed by Peabody at River King and other of its plants starting in 1957. The hauls, by McNally Pittsburg, employ coupler cars (two per plant) connected by rope so that cars to be loaded move one way on one track passing empties moving the other direction on the next track. One man handles the loading.

Automatic car-handling systems developed by Union Switch & Signal and, using, among other things, squeezers for control, were put in service at Moss No. 3 and also at the Corbin (Ky.) plant of U. S. Steel in 1957 and 1958. The year 1958 also saw full operation of a system using Sanford-Day equipment at the Seco (Ky.) plant of South East Coal Co.

Miscellaneous developments in the 1950-60 era included the first example of the use of stainless steel to sheath a plant (River King). Aluminum sheathing had been a sheathing material of several years' standing.

Heating of vibrating screens to prevent blending was an almost overnight development of the early 50s. Improvements in screen cloth and screen plate included new perforations for greater efficiency, and the introduction of rubber-coated plate in 1959.

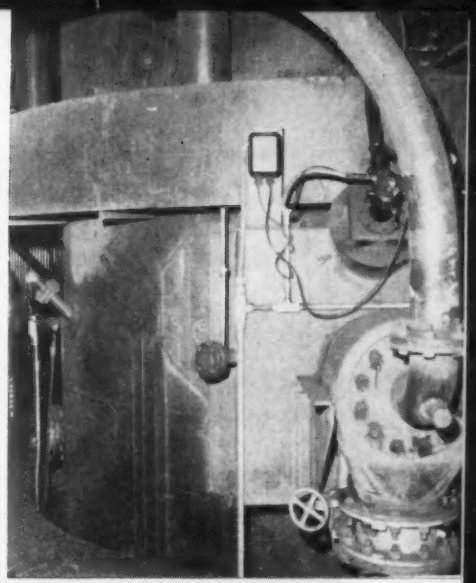
Use of salt and chloride for freezproofing, in addition to oil, increased, and oil use was extended by spraying the interiors of railroad cars to prevent coal from freezing on them.

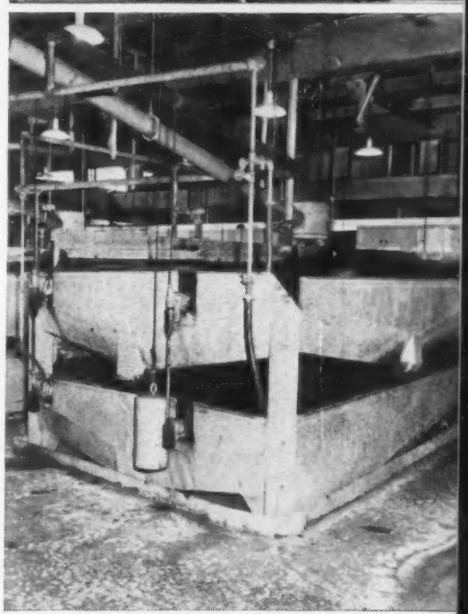
The Preparation Future

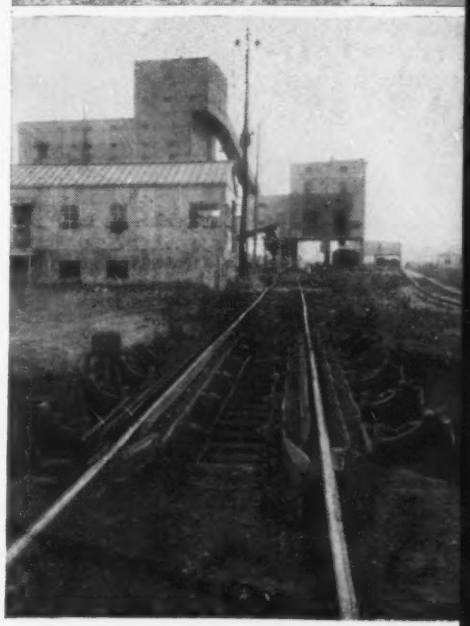
As of 1960, the percentage of bituminous coal and lignite mechanically cleaned had climbed to 65.7. Thermal drying percentage was over 15 and still gaining. The percentage of both should continue to rise, though raw-coal operation, primarily to serve a mine-mouth power plant, is finding an occasional taker. If the coal has to be hauled some distance, logic indicates that refuse be removed to keep from having to pay freight on a useless material—though ash already is finding use and may find more. Then there is the question of uniformity, which in itself is a valuable attribute. For these and other reasons, it is not likely that the rise in mechanical cleaning will halt anytime in the near future.

Though designs and mediums may change, it does not appear likely that the basic approach to cleaning, sizing, drying and the like will be radically different in the future. The paths to be followed in such auxiliary operations as water clarification, loading, storage, etc., also appear to be plainly marked.

The plant of the next few years, however, normally will be a larger plant and it may be computer controlled, with the computer automatically adjusting equipment operation to produce the size mix providing the maximum income. Even without the computer, operation with 1 or 2 men will be the rule. New materials and new designs, plus expenditure of the necessary money to get maximum breakdown resistance, will significantly reduce the cost of parts and labor, now one of the biggest items in the operation of modern low-operating-labor installations.







THEN **Only a few years ago** a change of shifts meant throngs of men at the portal and a jammed parking lot. But time and circumstances have worked changes in this, until . . .

NOW **The modern portal presents** an almost deserted atmosphere, even with more coal being produced. More machines mean fewer men, but men of greater skill and aptitude, both workers and supervisors.

Manpower for Coal's New Growth Era

MACHINES, MARKETS, MONEY, MEN—the greatest of these is men. The potential in machines, markets and money becomes kinetic only through the catalysis of imaginative managers and supervisors and intelligent, skilled workmen.

How many of these men and managers will be needed to produce the 625 to 650 million tons of coal the Nation will require in 1970? What skills and abilities will be required? Where are the men now? How can they best be recruited? What training will they need, who will provide it, and how will the training be done?

The Numbers Game

The number of men who will be employed in coal production in 1970 admittedly is anybody's "ball-park estimate." Familiarity with the stadium, however, may lead to a figure of reasonable substance.

In creating the picture of employment in 1970, certain assumptions must be made and certain operational trends must be considered.

Laying the ground rules for the analysis which is to follow, a start is made with two assumptions:

- That the Cold War will not ignite, and
- That the coal industry will average 220 working days per year.

Among the operational trends to be considered are these:

- Productivity in the 60s will continue to rise, but possibly not at the rate experienced in the 50s.
- Production from open-pit mines will increase as a percentage of total production.
- Automation of production operations, coal preparation in particular, is bound to increase.
- Mining machines with built-in breakdown resistance—at a price—will become more common.
- Production facilities will be more continuously utilized.

Justifying the Assumptions

The war question is in the lap of gods, so to speak.

The figure on average working time, 220 days per year, is considered the minimum at which high efficiency can be maintained. **This is in line with the theory that high capital costs for new mining capacity**

require that the facilities be used in a more continuous manner.

Also a factor leading to maximum working time is a trend toward tying the output of particular mines to single customers or specific end uses on long-term contracts. The result is that excessive over-capacity can be knocked out of a mine on the drawing board.

The 220-day figure is arrived at by excluding 52 weekends, the contract holidays and the miners' vacation, plus some slippage for the stoppages that sometimes occur.

Considering the Trends

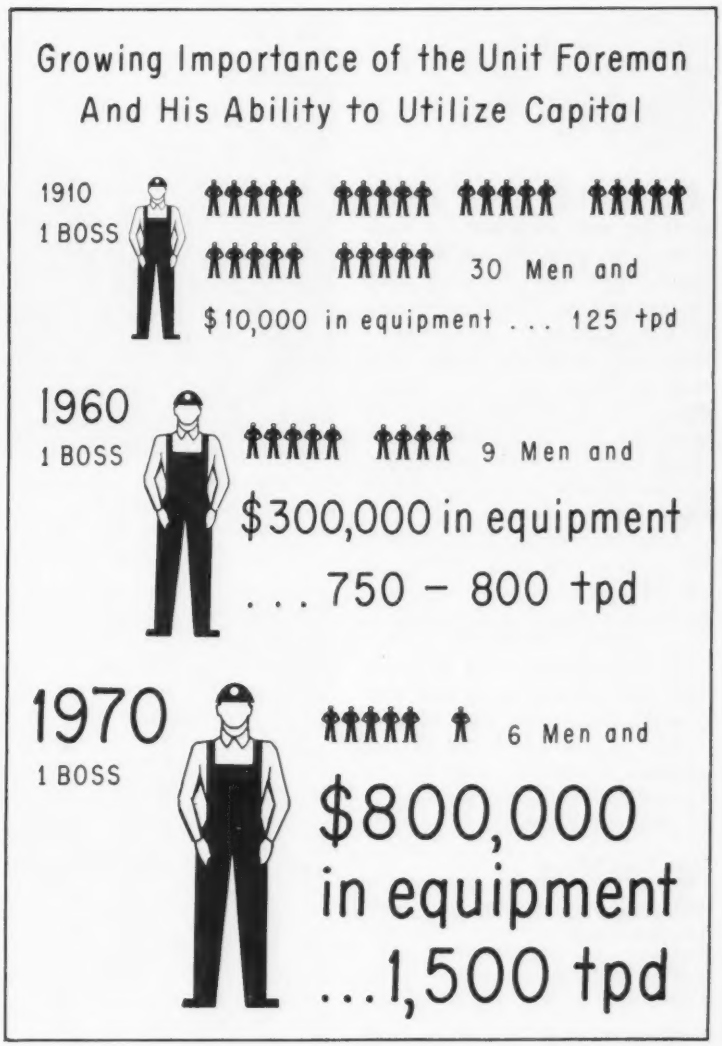
Coal in the post-World War II years recorded a saga of near-convulsive change—the almost total mechanization of production. Associated with this development was the drastic reduction in mine employment that resulted in "depressed area" situations in a number of coal fields.

Those days are about concluded, although coal-mining localities still have unemployment problems in the wake of the industry's head-long rush toward survival through mechanized mining. Productivity in the 60s will continue to rise, almost but not quite at the rate experienced in the 50s.

The outlook now is for a relatively orderly advance in productivity in bituminous mining, from 13.2 tons per man-day in 1960 to approximately 19 tons per man-day in 1970, as developed heretofore in the analysis on pp. 158-159. In 1970 production of bituminous coal will require the services of 145,000 hourly rate men, as compared with 169,000 in 1960.

In short, productivity will not double in the present decade as it has in the past, and jobs will not be eliminated at the former rate. The attrition in average employment will be more natural and gradual, while the increase in total output will keep the impact down.

The total figure on employment in 1970 reflects among other factors the growth in strip-mined coal as a percentage of the total and the higher productivity in strip mining —28 tons per man-day in 1970, compared with 17 tons per man-day in deep mining, for a combined productivity in bituminous of 19 tons per man-day, as previously set down.



This picture for 1970 shows production from open-pit mines aggregating 34% of total production in bituminous mining.

Also affecting employment as the decade unfolds will be steady advances in the automation of services and production activities. Low-labor coal preparation will advance at a rapid rate, including car-handling and loading. Power distribution and the monitoring of service lines will be automated to a greater degree.

Preprogrammed sequences of operations for mining machines are certain to come into wider use, and there should be some increase in longwall operations using automatically-advancing roof support. All these steps will tend to reduce the total number of men at work even while annual production rises to the 625 million-ton level in 1970.

Developments in the technology of machine design and materials indicate that mining equipment can and will be provided with built-in breakdown resistance. It will cost more, of course, and it will have an effect, where it is used, on the maintenance function and on the number of men involved in maintenance.

The situation will vary from mine to mine, depending upon method of mining, lay of the seams and natural conditions. As a case in point, coal mines using the breakdown-proof machines may find that advances of 400 ft or more per shift.

are feasible. Obviously, a host of service troops, relative to the face crew, might be required to keep power, ventilating air, water and supplies feeding into such a rapid advance.

Functional distribution of employees will be a matter for settlement by each company for each mine, but, generally speaking, the industry can expect a shift to more service men and fewer producers. By way of definition, producers include mining-machine crew, roof-support crew, face-haulage employees and section-assigned ventilation men, etc. All others, based for administrative purposes outby face-haulage transfer point, are service men.

A few years ago the Nation passed the point at which the number of service workers surpassed the number of producers, a result of increasing mechanization of all industry and of a rising standard of living. The coal industry, as a unit, may pass this point before very long.

The percentage distribution of employees in the coal industry, based upon their functions, appears to break down like this:

In Deep Mining

	Now	In 1970
Maintenance	20	25
Face operations	60	50
Services	10	20
Surface operations	10	5
	100	100

In Strip Mining

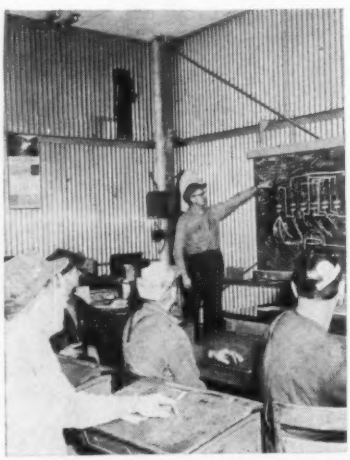
	Now	In 1970
Stripping and loading[1]	20	20
Maintenance	25	30
Services[2]	30	35
Coal preparation	25	15
	100	100

[1]Includes augering.
[2]Includes haulage.

In this strip-mining breakdown overburden preparation is considered a part of the stripping operation. Services include clerical functions, construction and maintenance of roads, warehousing and pit services, such as, fuel supply, explosives supply, dust allaying and so on. The maintenance force, for purposes of definition, is made up of mechanics, electricians, shop workers, welders and "bull gangs."

The stripping industry already has passed the point at which service workers outnumber producers, attesting to the influence of equipment development on numbers of employees and their functions.

CLOSER CONTROL of operations, under highly professional management, must become the rule as big machines further concentrate production.



IN-COMPANY TRAINING during working hours will grow as a means of upgrading performance of men already on the payroll.

More continuous utilization of production facilities will become an increasingly important factor in the mine-employment picture in this decade and beyond. The capital input required to maintain maximum efficiency in the highly competitive fuels industries will tote up to a high figure. More continuous utilization of the equipment purchased by this investment will (1) forestall obsolescence in production machines, (2) concentrate the production spearhead still further and (3) conserve manpower.

Assume the existence of a solid block of coal in a 6-ft seam. Assume further that this block is to be continuous-mined, on a three-shift basis, by machines that are built to run without breakdowns. One of these units, cutting 16 ft wide, would approach an output of a million tons per year.

Obviously, the three-shift operation complicates the maintenance function, but the solution to that problem is a matter of scheduling. Overlapping shifts, scheduled weekend work or intermittent maintenance shifts are possible solutions. **In any event, the million-ton mine employing only one unit is a distinct possibility.** The savings in ventilation and power distribution alone are really impressive.

Considering these and other factors leads to the view that mine employment in 1970 could be as follows:

	Men Employed	Productivity, Tons per Man-Day
Bituminous strip	35,000	28.0
Bituminous deep	110,000	17.0
Anthracite	9,000	8.0
Total	154,000	

Attracting Good Men

Now, where will they come from?

Coal's operatives of the future will come as always from the coal regions, but the competition for the services of the good ones will be keen. **Our population will be more mobile, the level of basic education will be higher and our improving communications will strengthen the lure of the glamour industries.**

To get the men they want coal companies must project a good local image, demonstrating progressive management. Some of the coal producers of 1970 and beyond now are sitting at their desks at local schoolhouses. They can be shown now the exciting nature of big-scale material moving, using machines that exist nowhere but in the coal industry.

Then they must be shown that the industry offers steady work at high pay, and that opportunities for advancement are increasing for trained men in coal. **Note that in West Virginia there has been a steady decline in the number of men directed by each supervisor. It seems reasonable to expect that more and better**

supervisors and technicians will be required to operate the coal plant of the future.

Wholesale recruiting is not for the coal industry. Forward-looking management is well-advised to select promising candidates from among local boys and young men and take an interest in their development.

Training for Service

There will be a need for all agencies now engaged in training efforts to continue with their missions. If there is anything new on the horizon it will probably show up in the development of technical institutes in mining areas. A project of this sort was given some study in central Pennsylvania a few years ago, but it was slightly ahead of its time. Some companies, after an honest appraisal of the idea, came to the conclusion that they could not offer positions to the graduates of such schools. They were deeply involved in placing their own men who were idled by the influx of machines.

However, in another 10 yr the panels may be exhausted and no labor surplus will exist. **The regional mining school will take on new importance. The view from here is that the technical institute will be a cooperative venture among producers of coal, equipment manufacturers, state universities and other interested agencies.**

All in all, good training programs will become increasingly important with the passage of time. Management of larger companies will have to strengthen their own training departments. Local associations of coal operators may be called upon to provide such services for constituent small companies.

Public pressure for increased safety in the mines may affect the training function to the extent that an apprentice system for equipment operators may result. Official certification for equipment operators, similar to that for shotfirers and electricians in many states, is not an impossible prospect.

In-company training and refresher courses during working hours should be evaluated for their potential benefits in upgrading manpower already on the premises. The quickened pace of operations may demand such steps, thus portending a bigger role for company training officials.

One more avenue must be traveled in helping the manpower of coal's challenging era to fullest possible development. That is, communicating the economic facts of life through well-prepared company publications or other media.

Building a Staff

Just as the industry will experience the trend toward more service workers and fewer actual producers it will also experience a relatively greater emphasis on strengthening staff functions than on strengthening the line organization. Operations planning, research and control will become increasingly important in the maintenance of the high efficiency that will be required.

This is the most likely area in which female engineers and technicians will enter the coal industry.

The times in which we live have been called the "Age of Explosion." The reference is to the population explosion, the changes wrought by the release of atomic energy, the race into space and, last but not least, the development of computer technology and its applications. As time passes, the products and by-products of data processing will have increasing influence on the conduct of operations, sales, accounting and so on.

People with special skills and training will be required in staff positions to provide the raw materials from which sound management decisions can be made. Data-processing programs and equipment must be evaluated now.

Planning for engineering manpower in the extractive industries should now be a direct concern of top management. Not necessarily quantity, but certainly quality, is of prime importance. Establishing a close association with young engineers and with the schools that train them is one way to build the desirable company image. The coal industry will need mining engineers capable of taking a three-dimensional view of coal deposits and their profitable recovery and utilization.

Electrical and mechanical engineers will be required in greater numbers to keep the physical plant in good working order. Civil engineers, with their skill in moving huge volumes of material in a planned manner, will be an asset to certain companies.

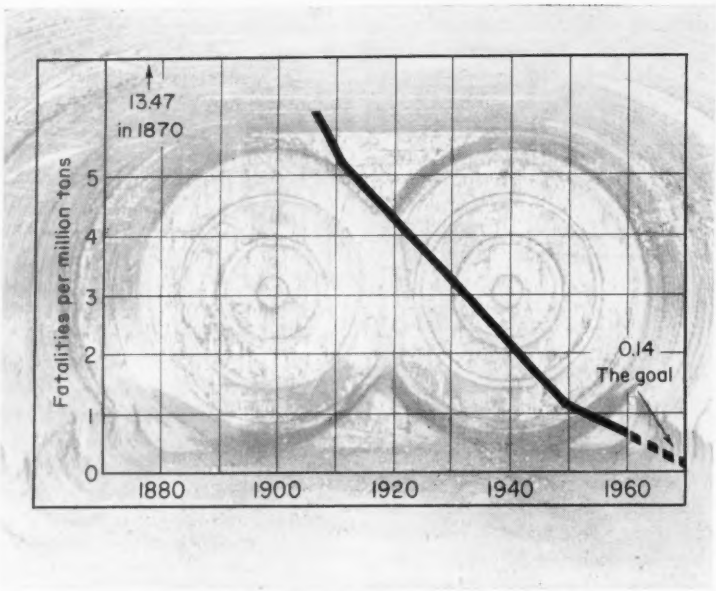
The long-hair pure-research artist may find a place on the company staff to serve as a dreamer and goad in opening new avenues. **It is estimated that in 1970 the working force in the U. S. will number 87 million people, most of them having some kind of special training. Other things being equal, the coal industry may find itself competing with industrial country clubs in filling manpower needs.** But the reservoir of 87 million insures that coal's manpower needs can be satisfied if the matter is given sufficient thought in time.

The Executive Function

As the tempo of operations increases in speed, as competition becomes more heated, as mining units rise in first-cost and lead to further concentration of production, there will be less tolerance of erroneous decisions at top management levels. A faster verdict on the quality of management decisions, written in the results achieved, will be the rule. These phenomena, also originating in the increasing speed of data processing, will press more and more toward scientific management. In the days ahead executive hunches had better be good—and right.

Therefore, creating an environment within the company in which promising people can pursue the fullest possible development of their talents is one of top management's greatest responsibilities. Studious selection and planned training of candidates for executive posts will help to insure steady continuity in positions of high responsibility.

The task of providing the right kind of manpower for the era ahead is not one of buying labor but of creating challenging situations in which whole men may find expression. The better-trained young man of the future will find the boundaries of his "locality" expanding. He will be in a better position to find his one best place, and he will be more inclined to look for it.



NOTABLE PROGRESS in the past and worthwhile goals for the coming decade highlight the coal industry's safety program.

The Safety Movement

Origins—

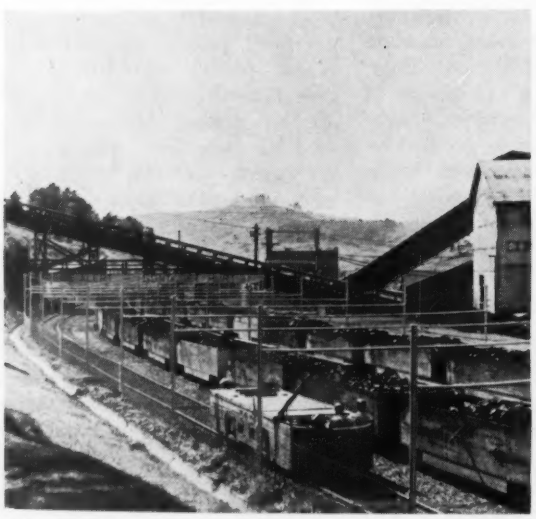
Development—

Goals for 1970

SAFETY IN COAL MINES has been remarkably improved for a number of good reasons in the 20th century. Research, legislation, organization, education and agitation—all these contribute to the development of the program and the record. In the creation of fire-resistant belt, cable, hydraulic fluid, in the growth of roof-bolting, in bulk rock-dusting, in foam-plug research we see safety advances crowding each other at center stage. Progress is accelerating.

In circumstances like these it seems somewhat unreal that the safety movement had its origins in a centuries-long search for a simple light that a miner could take underground in safety. **Appreciation for today's electric cap lamp grows as we realize that long before America was born European miners hung rotting fish skins at the face, and worked in the faint glow they emitted.** A tallow candle would have been so much better but so much more dangerous, as they had learned from bitter experience.

From halting beginnings and the rapid progress of today we look forward to this goal: That a man, any man, will not be subjected to the primal indignity of losing his life while working for a living in coal mines. The strides toward this goal are (1) full consideration for the operator's safety in machine designing, (2) maintenance of a safe working environment, (3) development of coal-recovery methods that serve



GOOD ENGINEERING, maintenance and housekeeping, as demonstrated at the deep mine and the strip mine, are essential factors in achieving maximum safety.

ELIMINATING "human error" as a cause of accidents is accomplished by setting and observing systems and patterns in operations. Roof bolting and self-advancing face shield are good examples.

safety first and (4) engendering personal concern for safety.

If a numerical safety goal is desired as a target for 1970, it should be based upon giving odds to the coal miner at least equal to those experienced by all industrial workers in the U. S. In 1960, the chances that an industrial worker (in mining, manufacturing, construction and utilities) would be fatally injured were 1 in 1,700, approximately. In coal mining the odds were 1 in 570, approximately. These figures are based upon working populations of more than 23 million men in general industry and 186,000 in coal mining, both anthracite and bituminous. There were 13,800 fatalities in industry and 326 in coal mining in 1960.

Assuming that *Coal Age* predictions on production and manpower in 1970 are borne out, the toll in fatal accidents will have to be reduced from the 326 of 1960 to approximately 90 in 1970, if the coal miner is to be favored by the odds generally prevailing in industry. Concluding this macabre exercise, the rate of fatalities per million tons of coal production would have to be reduced to 0.14 or lower. It was 0.75 in 1960.

The goal is neither unreasonable nor unattainable if the progress illustrated in the accompanying chart is continued. This requires constant pursuit of new ideas in safety and of better ways of doing jobs and better ways of making equipment, as illustrated in the following:

Mine Lighting

The history of mine lighting is a record of continuous development spurred by the longing of underground workers for high-level illumination to relieve the absolute blackness. Milestones in the search for better lighting—after the primitive fish skins and the Spedding spark producer—were the Clanny, Stephenson and Davy lamps and their contemporary types, the messy oil lamp, the carbide lamp and, finally, the electric cap which itself writes a history of evolution. **The Clanny-Davy-type lamps, forerunners of the modern flame safety lamps which are now employed solely as gas-detecting devices, were originally developed to provide safe illumination, inadequate at best.**

The carbide lamp, in which calcium carbide and water were mixed to provide acetylene, was a real breakthrough as far as illumination was concerned, but it still was an open light. However, it had the market fairly cornered by 1911 when the first issue of *Coal Age* appeared.

Even at that time there was some interest in the development of an electric cap lamp, including the work done by Philadelphia & Reading Coal & Iron Co. early in the century. The earliest models have been continuously refined to increase candlepower, to provide fail-safe features and auxiliary bulbs or filaments, to decrease weight and to improve battery capacity.

The search continues. Improved models of cap lamps, and the hard hats to go with them, appear regularly. Furthermore, headlights for today's mobile equipment have been brought to a high degree of dependability and ruggedness.

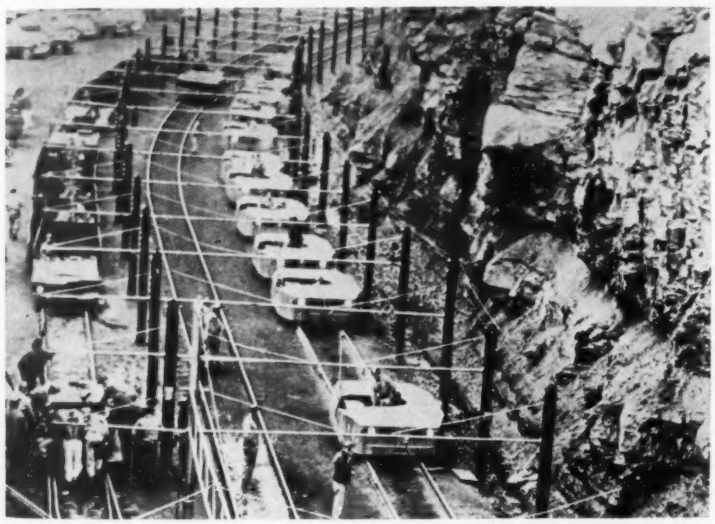
As this is written the production of improved, sturdy fixtures for better area lighting underground is well underway. Chances are good that by 1970 many mines will use approved fluorescent lighting systems in face areas, approaching more closely the level of illumination now deemed necessary in factories.

Methane Control

Gas-control measures in the long history of coal mining range all the way from the occult to the plupositive—from the dim past when a man in a ludicrous costume threatened the methane with a stick to drive it out of the mine up to the present interest in draining the gas from the seams prior to mining.

The modern approach is to eliminate as much as possible the factor

TRANSPORTATION can be reduced by automating railroad-car handling and by providing transportation facilities for men that have been designed with safety the paramount objective.



NOTABLE PROGRESS in the past and worthwhile goals for the coming decade highlight the coal industry's safety program.

of human judgment in diluting, sweeping away and rendering harmless the explosive methane. Although the flame safety lamp still is a potent weapon against gas and still indispensable as a detecting device at the face, the newer detectors depend primarily upon the changes in electrical properties affecetd in certain preheated materials by the presence of methane. These changes are then calibrated into gage readings which all men see at the same value.

A logical extension of the art is to employ the changes in electrical properties as control stimuli to sound warnings, disconnect power or whatever. The need for human judgment and human decision thus are eliminated. Such methane control systems are undergoing intense development right now under the aegis of the Bureau of Mines and instrument makers.

Coal's first decade in continuous mining, 1950-60, was marked by the introduction of continuous systems into workings that had not been projected for the amazing speed of advance that proved possible. **The methane problem was aggravated. As a result the technology of ventilation was revolutionized, primarily to handle the increased volumes of methane emitted per unit of time.** An increased use of bleeder-entry systems, the reintroduction of auxiliary fans and diffusers, the tightened discipline in brattice work and the coursing of larger volumes of air to the face are notable examples of how workings and methods were modified in the recent past to suit the new machines.

As time passes these steps may be viewed as expedients, inasmuch as new mines will be projected for high-speed recovery. Concentration, always a boon to safety, is the key. Ventilation will be simplified. Methane drainage prior to mining will be more prevalent, and bleeding gob areas through boreholes to the surface may become a widespread practice. The outlook is that methane control will be more precise, thus inhibiting the incidence of ignitions and explosions.

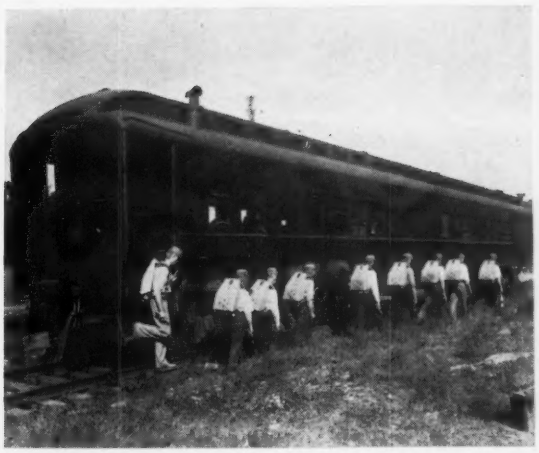
Rock Dusting

The philosophical arguments heated up throughout the 19th century and into the 20th century, overseas and here, as to whether or not coal dust entered into explosions and whether or not it would explode in the absence of methane. Soon after the turn of the century it was generally agreed that coal dust was a hazard in itself. Furthermore, it was a growing hazard in view of changes in mining methods that resulted in the production of more fines.

It was recognized late in the 19th century that the presence of rock dust could limit the spread of a coal-dust explosion. Speaking before the Illinois Mining Institute in 1893, George S. Rice suggested that natural clay dust had limited the area ravaged by the explosion which occurred at Pekay mine, in Iowa, Feb. 14, 1893.

Adobe dust was used in the mines of Victor-American Fuel Co., in Colorado, as early as 1911, perhaps the first use of rock dust as an explosion-inhibitor in the U. S. However, since there were no standards at the time as to how much free silica was harmful to the miners' lungs the practice was discontinued. The U. S. Bureau of Mines, created in 1910 to cope with the increasing problem of mine accidents, has been an extremely active participant in all mine safety activities, dust control and all others. Born 1½ yr before the first issue of *Coal Age* was published, the Bureau has grown tremendously in influence and impact on matters of safety.

The selection of pulverized limestone as the most suitable depressant in coal dust hung on this question of free-silica content. The specified limestone now used for rockdusting



MILESTONES IN SAFETY—The Bureau of Mines takes to the field on its safety-training mission. At right is John T. Ryan, co-founder of Mine Safety Appliances Co., at the scene of an explosion in 1911. His efforts helped to replace the canary with positive instruments for gas detection.

is practically devoid of free silica.

The name of John E. Jones, late, of Illinois, should be remembered as the evangelist of modern rockdusting.

Coinciding with the development of rockdusting materials and equipment (the first mechanized distributor came out in 1911) was the creation of short-flame, permissible explosives, beginning about 1904. This giant step in safety eliminated the hazards of the old powder keg and hand-made charges where the permissibles were adopted for breaking coal from the face.

Rockdusting has presented its problems, the biggest headache being the problem of keeping the rockdusting operation in the conventional mining cycle without harassing the men at the face or unduly delaying production. Wet rockdusting was the answer. The prototype unit was made at Mine No. 17, Peabody Coal Co., Pana, Ill., in the mid 50s using an old clothes-washing machine in which the slurry was mixed in the tub by the agitator. Next big step was the development of slurry distributors that rode piggyback on face machines. Air-fluidized handling of rock dust made the news in 1960, and is really coming into its own as this is written. This technique, pioneered by Mine Safety Appliances Co., will find much wider application in the 10 yr ahead because of its utility and economy.

A big problem which appears to lie ahead is the need for another boost in the required "percent incombustible" in total mine dust, from the present 65% to some higher figure. **Without a doubt there will be greater emphasis on better cleanup, improved dust suppression methods at the face and continuing research in foam suppressants allaying with water.**

Fire Prevention

One of the direct results of the Avondale disaster, Sept. 6, 1869, at Plymouth, Pa., a mine fire in which 110 men lost their lives, was a Pennsylvania law specifying the minimum distance from the shaft or opening at which surface buildings could be erected. The fire began in a wooden tipple over the shaft. The Avondale disaster goes down in history as the event which set off irresistible demands for social legislation to protect coal miners in the U. S. Out of it came the first governmental inspection force—and the first state mining laws.

From these beginnings came a number of rulings on the use of combustible materials in mine construction, underground and on the surface. As time passed, greater emphasis was placed on installing water lines, first in surface structures, then underground, for the express purpose of fighting fires. One modern mine went to a system in which the same lines could be used for mine drainage or for firefighting by reversing the flow. A standpipe on the surface provides water for firefighting.

It is common practice now to provide and encourage the use of primary extinguishing agents at the face, such as rock dust, chemical extinguishers and so on, and to back this up with high-capacity fire trucks and foam generators in secondary assault on fires. Training for emergency action gets more attention, too.

However, the greatest advances in fire prevention have been made in the relatively recent past with the introduction and adoption of fire-resistant conveyor belting, trailing-cable jackets and hydraulic fluids. It appears that universal adoption will become mandatory in time, especially since the fire-resistant equipment will be made every bit as good as the other.

Roof Control

On Jun. 28, 1896, at Twin Colliery, Pittston, Pa., 58 men died under a massive roof fall. There have not been many catastrophes like that at the Twin, but over the years in which coal has been mined in the U. S. falls of material have exacted a horrendous toll in human life, snatching away one life here and one there in appalling regularity. Wonderful progress has been made, yet the roof fall continues as the No. 1 menace.

As in methane control, the hope for greater protection from roof accidents rests in eliminating as much as possible the factors of human judgment and human decision in

evaluating roof conditions and in setting support.

In the early days the miner tested his roof and decided whether or not support should be provided, where and how much. Out of a realization that the roof contained too many variables to be safely handled on this basis, the industry began to set up inviolable minimum standards for roof support. This was the first big step in eliminating human judgment, and the results began to show.

Roof bolting in definite patterns added another factor of safety, and the tightening of these bolts to specified torque values added still another. Visual tension indicators, in which all observers can read the same message, are similar in purpose to the gages of modern gas detectors.

In like manner, the 4-piece square sets of the past have given way to yieldable steel arches for special applications, mainly because the yieldable steel arch is more predictable in its performance. Uniformity in materials and workmanship are big advantages.

Yielding steel props, steel safety jacks for temporary support and collapsible cribs have made their contributions to greater roof safety, especially where recovery of supports in pillar robbing is necessary to secure proper roof breakage. Concurrent roof bolting, using machines permanently attached to continuous miners (originating in the 50s at Warwick mine, Duquesne Light Co.), constituted a major advance in safety at the immediate face.

Noting how roof-support discipline has advanced from full reliance on judgment to increasing reliance on pattern and system, one is led to believe that the coming decade will see a most welcome decrease in the frequency of roof-fall accidents. This progress will be the result of increasing pressure from all agencies for improvement and the application of technological advances, such as, the self-advancing roof shield for face areas and the new fully-automatic roof-support systems now coming into use in the U. S.

Safer Services

In face preparation, transportation of men underground, power distribution and recovery work the effects of long research are apparent in the safety improvements that have resulted. For example, deadly black powder gave way to the permissibles and the air and carbon dioxide systems of coal breaking. The long walk from portal to face or the long ride in open cars has given way to covered, insulated man cars or even self-propelled cars for individual crews.

Tighter controls on the installation and maintenance of power-distribution facilities have led the industry from reliance on the continuity of a grounding conductor to the more positive safety of electronic power interrupters in the event of ground faults. In some instances, permanent refuges are now constructed underground to eliminate a need for making a heads-tails decision as to whether to barricade or not. And the foam-plug method of fighting mine fires has been developed to a high degree of effectiveness.

Other new studies, loaded with safety advantages, include current tests on using short delay blasting in underground construction, thus making it unnecessary to charge succeeding holes under unsafe conditions. Multiple shooting with air at the face also is a boon to safety.

Coupled with constantly improving communications throughout the entire mining property, these steps represent outstanding milestones in the industry's progress toward maximum safety for the underground worker. The problems facing the safety fraternity in mining always were great. Changes in methods down through the years have aggravated these problems, but they are now being brought down to manageable proportions through research and cooperative action.

On the Surface

Electrical hazards, pit slides and trucking accidents present the strip-mine safety engineer with his own set of problems. However, today's big stripping operation is a model of applied engineering, which in itself denotes safer working conditions. Power distribution in most instances is up to utility standards. Expanding knowledge of soil and rock mechanics and of overburden blasting is applied to make the work safer.

The very size of the machines now moving materials at many strip mines provides armor for the operators. Reasonable care and top-flight supervision and inspection will be instrumental in increasing safety in stripping, thus enhancing the safety performance of the entire industry as the proportion of strip-mined coal increases.

In preparation the biggest advances down through the years have resulted from improvements in plant design, including provisions for more clear working space, centralization of plant controls, better machine guards, safer drying equipment, washdown possibilities for dust removal and the use of fireproof construction materials. Vastly improved in-plant lighting also has been a great help.

Perhaps one of the biggest helps has been the full- or partial-automation of car handling which reduces the heretofore shocking number of accidents among car runners. Automation increases productivity; it has eliminated jobs, but it does enhance safety by reducing exposure to admittedly dangerous situations.

On Capitol Hills

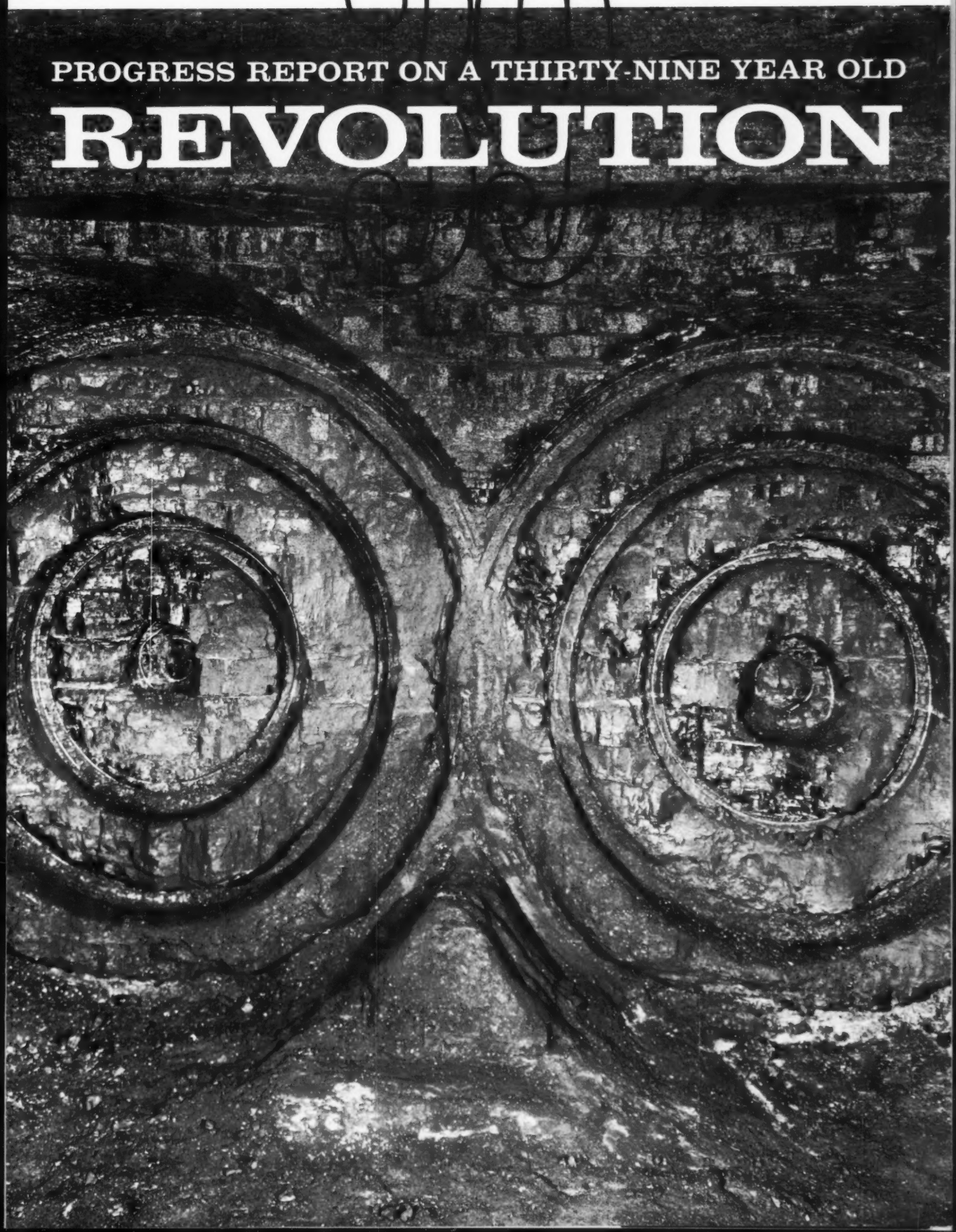
Not only in Washington, but in state capitals as well, the legislative processes continue to prescribe ground rules for mine safety in a continuous aftermath of the fire at Avondale. State after state is recodifying mining laws to bring them more into step with today's equipment, practices and research findings.

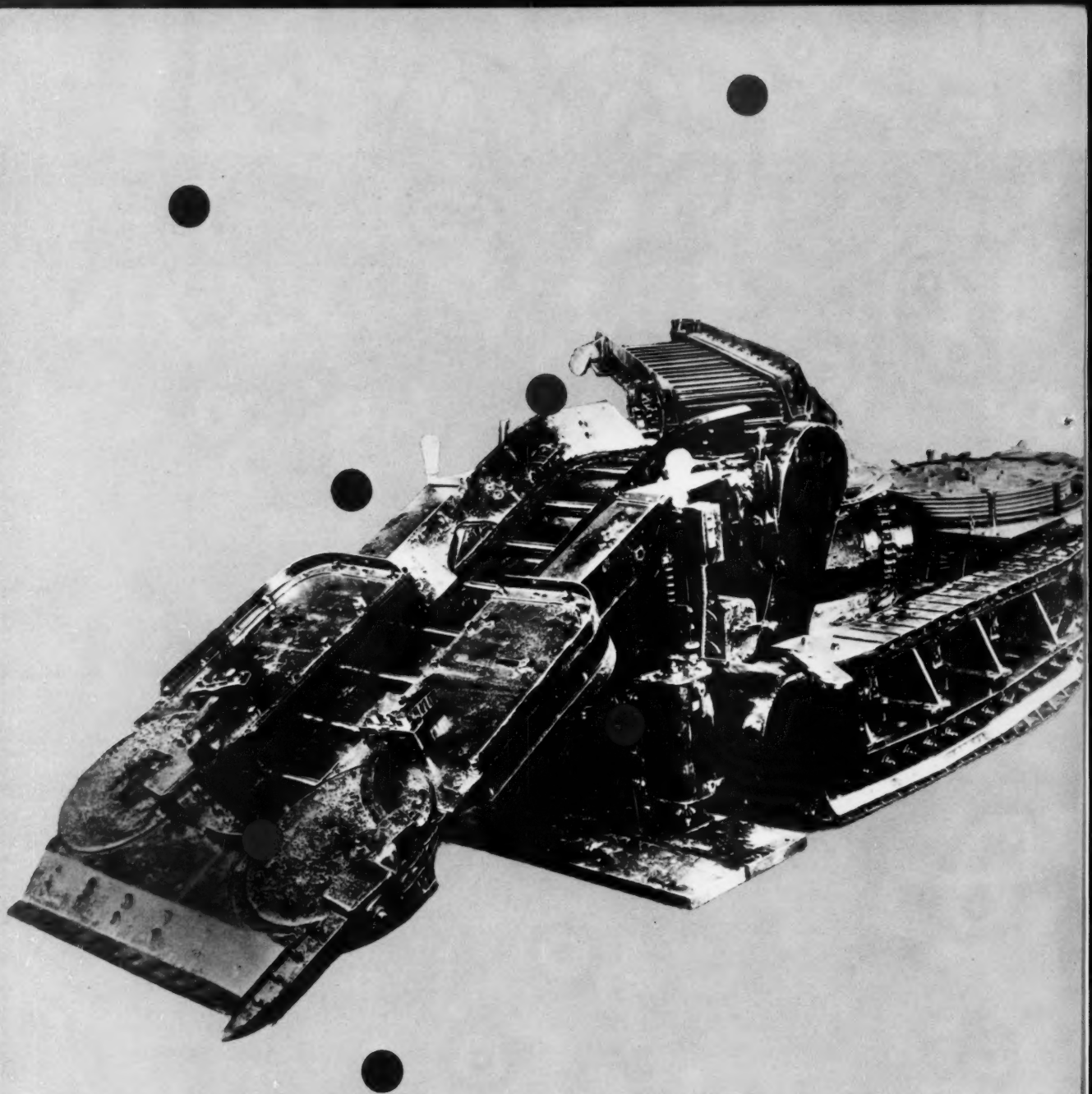
The enactment of the Federal Coal Mine Safety Act and the establishment of the code, the cooperative alinement of the efforts of a number of states to this code, the setting of standards for electrical installations and the creation of the coal-mine safety board of review machinery, all within the 50s, lay the groundwork for accelerated progress in the 60s.

There is assurance in the virility of safety research and in the evident willingness to cooperate that coal mining will take giant strides, maybe even attaining or surpassing the goal previously set down for 1970.

PROGRESS REPORT ON A THIRTY-NINE YEAR OLD

REVOLUTION





1916

Prototype of the Joy Loader which was to revolutionize coal mining was built in 1916.

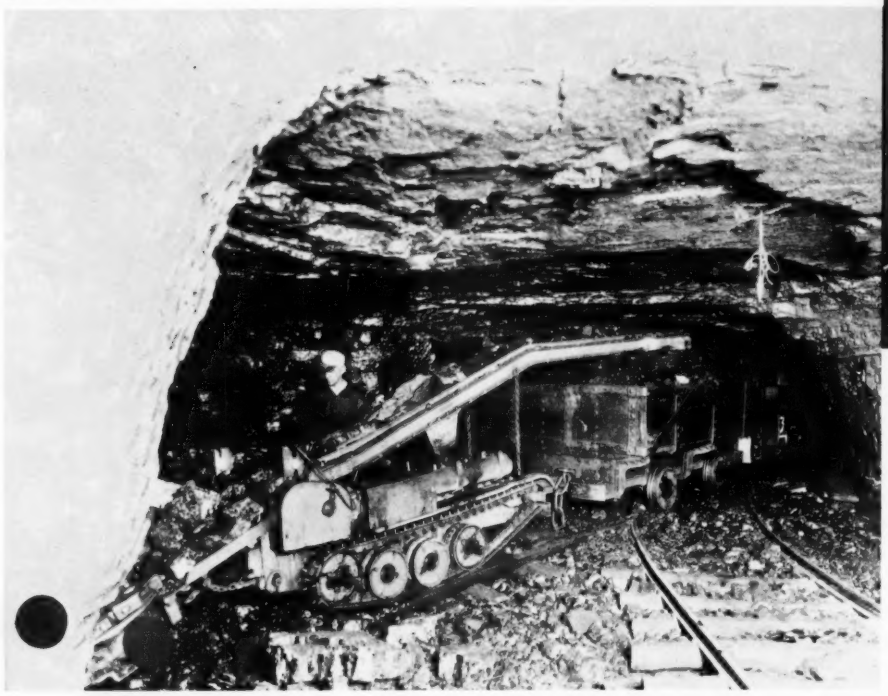
Thirty-nine years ago Joy introduced the trackless loader. Although this event did not mark the entry of Joy into the coal machinery field, for its cutters had been underground for nearly twenty years, the Joy loader did start the *first great wave* of mine mechanization. The trackless loader was not merely a better piece of equipment, it reflected a revolutionary approach to coal mining which was to affect the basic fundamentals of an industry almost unchanged for over a century. This mechanization which was sparked by the Joy loader has raised output per man from the four tons of 1922 to over twelve tons per man hour in 1960. The output in the years to come will go higher, for the revolution is far from being over.

1922

Large scale adoption of the crawler-mounted loader was the beginning of off-track mining with its undreamed-of mobility and increased productivity.

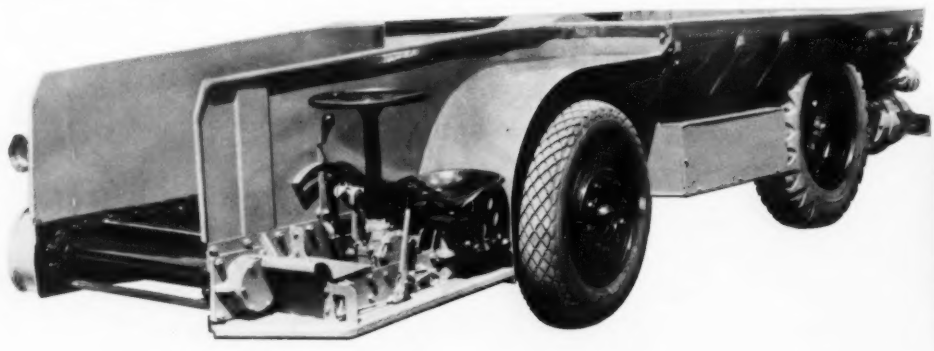
Here is what has happened in thirty-nine years

Economic revolutions, like shooting wars, consist of long periods of minor skirmishing, or refining of existing equipment, punctuated by great battles, or revolutionary breakthroughs on some front. Once each decade, starting with the early twenties, Joy has successfully assaulted a new front in the battle to cut coal mining costs.



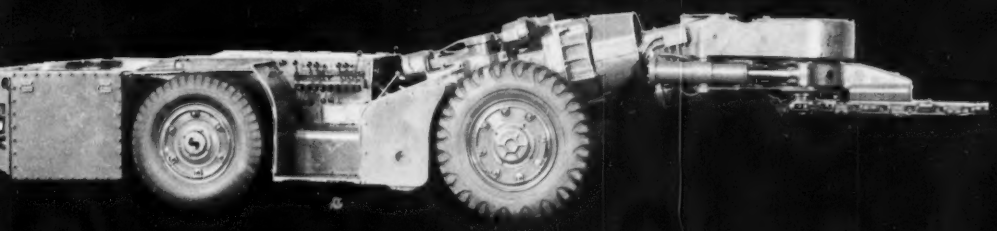
1938

The next logical step was taken with the advent of the rubber-tired shuttle car, improving intermediate haulage.



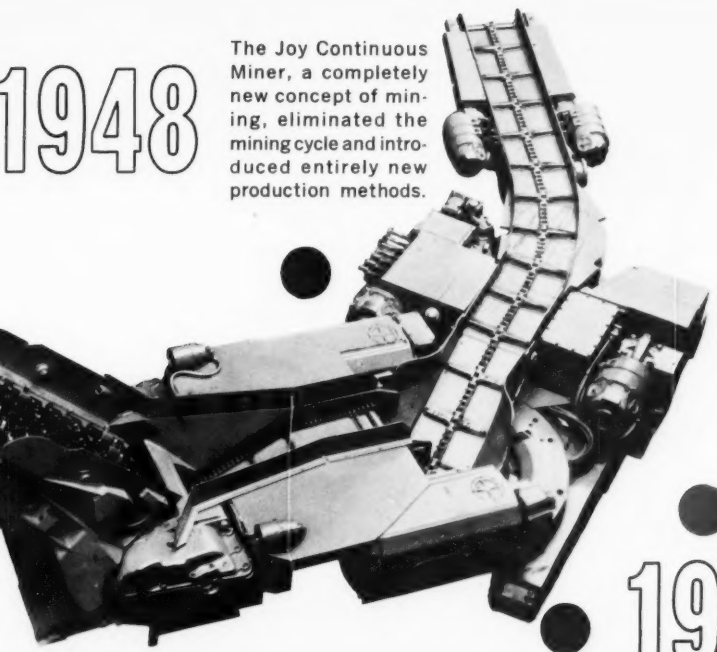
Joy Face Drills and 10RU-Cutters gave productivity another big boost as they came into service during the war.

1945



1948

The Joy Continuous Miner, a completely new concept of mining, eliminated the mining cycle and introduced entirely new production methods.

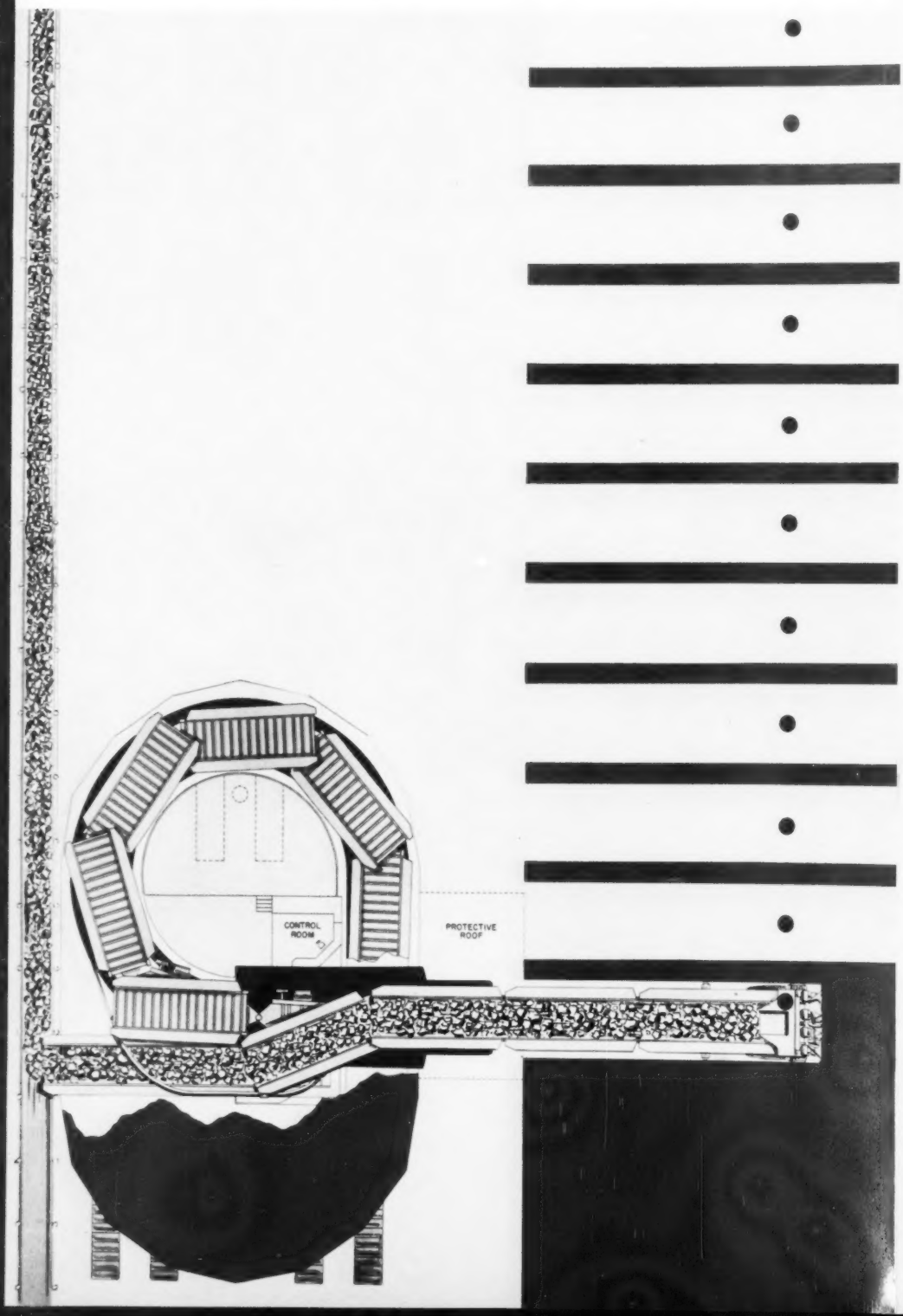


1957

Joy introduced a boring type miner to capitalize on the production advantages of a full-face machine.

THE REVOLUTION IN THE 60'S

Joy has always been an innovator, not an imitator. As we move into the '60's, Joy has launched a new offensive against strip mining costs with the introduction of the Push-Button Miner for highwalls. This machine and others still on the drawing boards will make Joy more than ever the company to which the Coal Industry can look for leadership in mining machinery.



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1. Over 1,000,000 sc
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3. Parts depots in elev
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WORLD
UNDER

IS WHAT PRODUCED THE REVOLUTION

ize an industry involving production in excess of 400 million tons, a power- needed. Following every major breakthrough new skills had to be acquired nen and machines became more valuable.

machines grew in numbers and complexity, repair and service facilities had d and improved. Parts depots had to be moved out into coal fields, and the parts manufacture and stocking completely automated.

00 sq. ft. of manufacturing space is oly the volume of Joy machinery for the argest plant capacity in the industry.

2. Research and development work on new principles, new metallurgy, and new designs is carried out at the Joy Experimental Station.

eleven cities are maintained to pro- rts availability to mines in every major

4. Programming of parts manufacture, and depot inventory levels is completely automated and electronic computer controlled.

RLD'S LARGEST MANUFACTURER OF ERGROUND MINING MACHINERY

Consult a Joy Engineer about all these Joy products: Continuous Miners • Loaders • Shuttle Cars • Shuttle Car Elevators • Cutters • Face Drills • Roof Drills • Conveyors • Belt Feeders • Mine Fans • Portable Blowers • Coal Augers • Blast Hole Drills • Dust Collectors • Hazemag Impact Crushers • Hoists • Core Drills • Core Drilling by Contract • Safety Circuit Centers • Vulcanizers • Cable Connectors • Rock Drills • Rock Bits • Hydro Drill Jibs • Portable Lighting Lines • Air Compressors

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

3690

COAL AGE

. . . And Coal

Rendering the best-possible technical, production, news and related services as its contribution to coal progress and profit through better service to the public has been the goal of *Coal Age* for half a century. It will continue to honor that obligation to the fullest in the new growth era ahead.

COAL AGE was the creation of John A. Hill, ex-locomotive engineman. With James H. McGraw Sr., ex-school teacher, and a few others, he was one of the men whose high principles and progressive practices are still today the foundations of the technical and business publication industry throughout the world.

At the time of the first issue of *Coal Age*—Oct. 14, 1911—the Hill Publishing Co., 505 Pearl St., New York, and the McGraw Publishing Co., 239 W. 39th St., New York, were separate organizations operating largely in separate business and technical areas.

Their first joint operation was the merger of their book departments in July, 1909. Part of the preliminaries was a coin toss, the winner to have his name first in the hyphenated corporation title and the loser to become president. Thus the McGraw-Hill Book Co., Inc., was born.

Hill died of a heart attack Jan. 24, 1916, while being driven to work from his home in New Jersey. Control passed to Arthur Baldwin as trustee, and he and Mr. McGraw, later in the year, combined the publication and other operations into—following the naming pattern already set—the McGraw-Hill Publishing Co., Inc.

The larger venture took up headquarters in a new building which had been put up by Hill at 10th Ave. & 36th St., New York. As an example of vision and the drive that converted vision into action characterizing both Mr. Hill and Mr. McGraw, this building was the first multistory or skyscraper edifice anywhere in the world to be fully air-conditioned. It took, in those days, a basement full of machinery, but control, especially of humidity, was poor. Also few in those days could stand the thought of working in the summer without open windows. As a result the operation was discontinued and the equipment removed.

Origins

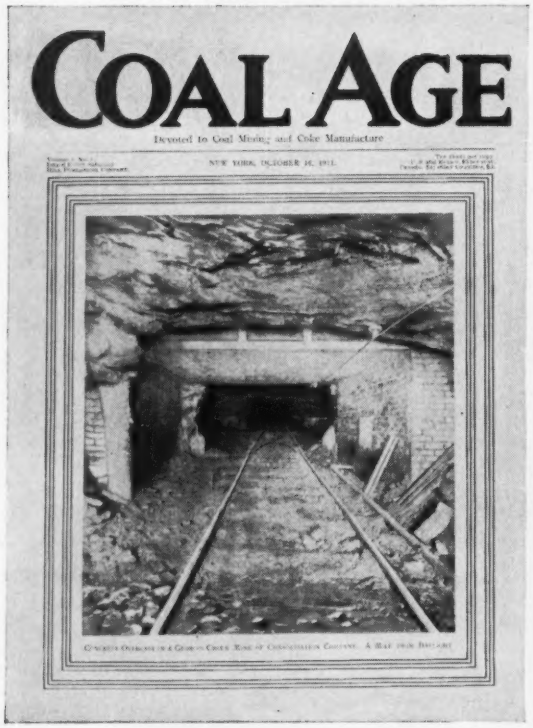
Coverage of the coal-mining and coking industries was not a new idea in the Hill setup when *Coal Age* was organized. One of the Hill publications, now a part of McGraw-Hill and presently in its 95th year of service, was *Engineering and Mining*

Half-Century Advertisers

The part that manufacturers of equipment and supplies have played in the advance of the coal industry has been noted in *Coal Age* on numerous occasions. It has been a major part and the editors are again happy to call attention to it.

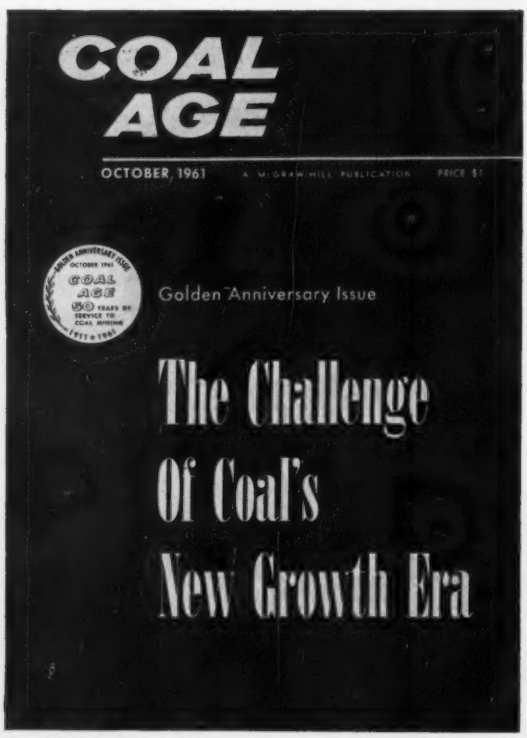
Many manufacturers now making important contributions were not in business 50 yr ago for the simple reason that the equipment and materials they provide were not in existence at that time and have been developed since. But many other manufacturers were very much in business a half century ago—and were advertisers in *Coal Age*.

Many are still advertisers 50 yr later. For their names, and for the names of those who were in the Silver Jubilee Issue of *Coal Age* in 1936, see the special index section in this issue (p 326). Even better, take a look at their advertisements—and at the advertisements of all companies in this issue. They, as well as the editorial content, make a news and information contribution of real value.



COAL AGE October 14, 1911

JOHN A. HILL
Publisher



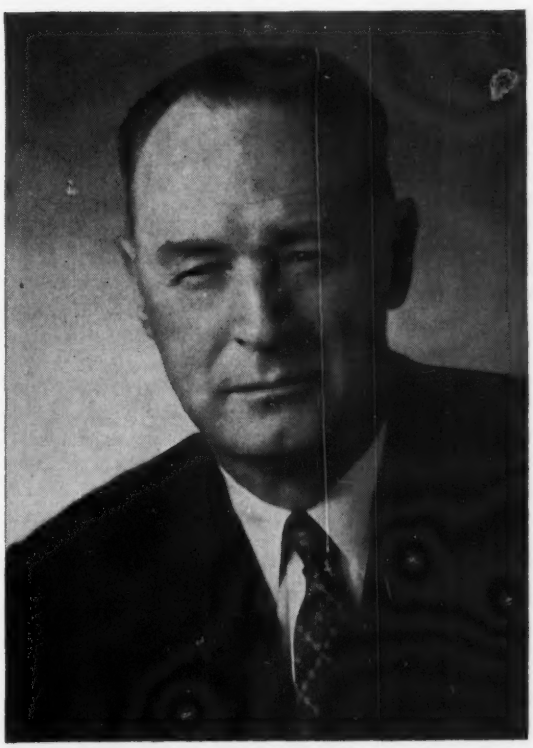
COAL AGE October, 1961

DONALD C. McGRAW JR.
Publisher

FLOYD W. PARSONS
Editor

John A. Hill was born in Sandgate, Vt., 1858, the family later migrating to Wisconsin. At 14 he became an apprentice in a print shop. In 1878, at the age of 20, he was drawn to Colorado by the silver rush, but wound up firing a locomotive on the D. & R. G., later becoming engineman. But he liked writing and began contributing to *American Machinist*. When its owners decided to start a new publication, *Locomotive Engineer*, later *Locomotive Engineering*, in view of the quantity and quality of his contributions, it was natural for them to ask Hill to become editor. With the help of Angus Sinclair he bought the magazine in 1891. *American Machinist* was acquired in 1896. Hill bought Sinclair's interest in *American Machinist* in 1900, in turn selling his interest in *Locomotive Engineering* to Sinclair. In 1902 he established the Hill Publishing Co. Death came from a heart attack in 1914.

Floyd W. Parsons was a native of West Virginia and studied at the University of West Virginia and Lehigh, receiving an engineer of mines degree from the latter. After graduation he was mining engineer for the Stonewall Coal Co., later becoming chief engineer. He then held a succession of positions—district engineer, Lehigh Valley Coal Co.; assistant engineer, Fairmont Coal Co., later Consolidation Coal Co.; chief engineer, New River Collieries Co.; instructor in mining, Michigan College of Mines; and chief engineer, Victor-American Fuel Co., Denver, Colo., before joining *Engineering and Mining Journal* as associate editor, from which he moved to *Coal Age* as editor when that publication went into operation.



IVAN A. GIVEN
Editor

Donald C. McGraw Jr. became publisher of *Coal Age* in mid-1959 after a wide experience in advertising sales and publishing practice. He attended the College of William and Mary and Carnegie Institute of Technology and served on active duty in the U. S. Naval Reserve for 4 yr. He joined McGraw-Hill in August, 1950, after having been associated with G. M. Basford Co., advertising agency, and the *Flower Grower* magazine as an advertising salesman. With McGraw-Hill he has been in advertising sales for *Product Engineering* in the Atlantic District, later becoming associate manager of the Eastern District, assistant director of advertising sales, advertising sales manager of the mining publications, and associate publisher, *Industrial Distribution*.

Ivan A. Given, a native of West Virginia, was born in 1902, the same year the Hill Publishing Co. was established. Govan colliery, near Glasgow, where compressed air was first introduced for cutting, bore an earlier version of the family name. A graduate of West Virginia School of Mines in 1926, and again in 1928 with a master's in engineering of mines, he is also an Island Creek alumnus, having spent some 2½ yr with that organization in various laboring and supervisory capacities. He came to McGraw-Hill in 1928 as a 10-wk trainee, joining *Coal Age* at the end of the training period. He is the author of "The Mechanical Loading of Coal Underground," published by McGraw-Hill in 1944 and perhaps still the only book of its kind ever written.

Serving Coal in Past Years

Chief editors of *Coal Age* in the years between Floyd W. Parsons and Ivan A. Given numbered four. They were:

R. Dawson Hall—Mr. Hall, who was brought in July 14, 1911, several months ahead of the first issue, to help develop the editorial formula and put it into effect, was given responsibility for editorial operations when Parsons resigned to become an independent journalist and writer early in 1919. Mr. Hall then took over engineering and production as co-editor with C. E. Lesher in 1920. When Mr. Lesher went with Pittsburgh Coal in 1924 Mr. Hall again assumed complete responsibility until 1927, when John M. Carmody was appointed editor, permitting Mr. Hall to return to the engineering editor post.

Almost universally known as "R. Dawson," Mr. Hall was born in England and aimed at civil engineering in his education. His conversion to mining engineering followed his coming to the U. S. in 1892, when he entered the employ of Alfred Herdman, then engineer for the Shawmut interests. On Mr. Herdman's resignation, Mr. Hall succeeded him as chief engineer for the company, and also served as general superintendent. In 1901 he opened an office at Dubois, Pa., as consulting engineer, continuing in a growing practice until joining *Coal Age*.

Mr. Hall retired at the end of 1916 and, though crowding 90, lives an active life at his home in Forest Hills, N. Y. One other man still alive shares the distinction of working through to retirement on the *Coal Age* editorial staff. He is J. H. "Jack" Edwards, now living in and traveling extensively out of Tucson, Ariz. Both he and Mr. Hall ask to be remembered to their many friends from their years on *Coal Age*.

C. E. Lesher—A native of Colorado, Mr. Lesher, after a few years professionally in the U. S. and Canada, joined the USGS and for several years was engaged in coal statistical and other governmental work. After World War I he was appointed director of the National Coal Association's Bureau of Economics, coming to *Coal Age* in 1920 as co-editor, with coal utilization and distribution as his particular responsibilities. He was made editor in 1922 and in 1924 joined the Pittsburgh Coal Co., rising to its presidency. He is now a consulting engineer with headquarters in Pittsburgh.

John M. Carmody—Serving some 18 mo before moving on to another McGraw-Hill publication, Mr. Carmody had an industrial relations background and functioned in that capacity for the U. S. Coal Commission, later becoming vice president of the Davis Coal & Coke Co. He joined *Coal Age* in January, 1927, and left McGraw-Hill in the early days of the Roosevelt regime. An ardent New Dealer, he became REA director and a member of the U. S. Maritime Commission, as well as a member, with Harry Hopkins and others, of the influential "Kitchen Cabinet." Mr. Carmody now lives in Washington, D. C.

Sydney A. Hale—Mr. Hale joined *Coal Age* in 1925. Previously he had worked for a number of coal and other publications and independently, specializing in transportation, markets and labor relations. He became managing editor of *Coal Age* in 1927, and was named chief editor in 1929, holding the position until his death Aug. 13, 1942.

Present members of the *Coal Age* editorial staff, in addition to the chief editor, appear on the following page.

Journal. Until 1869 it was the *American Journal of Mining*, established by the Western brothers. The brothers sold it to the Scientific Publishing Co., from which Rossiter W. Raymond acquired it in 1867.

Coal was one of the *Journal's* mainstays from the start, and one of the earliest of the coal journalists, who eventually acquired control of the publication, was Richard Rothwell, a hero among Pennsylvania coal miners in the 1860s for his rescue work after explosions, and more especially for his work in trying to prevent them. Upon Rothwell's death, the publication was sold to Mr. McGraw, who quickly resold it. After passing through the hands of several owners, it was acquired by Hill in 1906.

The coal industry in the meantime had been growing at a fast clip—doubling every 10 yr as a matter of fact. It became obvious to some of his staff and to Mr. Hill that the coal department of *Engineering and Mining Journal* was an inadequate means of realizing on an opportunity, in addition to the added difficulties of trying to cover two industries—metal and coal—that were substantially dissimilar in one publication.

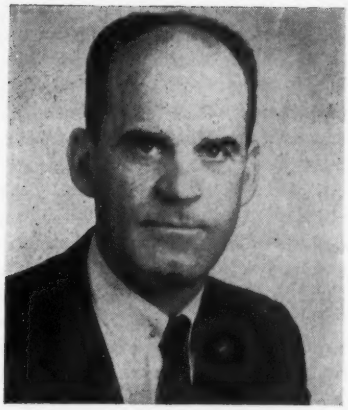
The decision therefore was reached to establish *Coal Age*, though it also was decided to continue some coal coverage in *Engineering and Mining Journal*, and this was done for several years.

When it was established *Coal Age* also did not stand as the first publication solely concerned with coal mining and related interests nor, leaving out *Engineering and Mining Journal*, was it the only one dealing with the industry at that time. Earlier publications, as a matter of fact, had included *Coal*, taken over by the *Journal* in the mid-1880s. And shortly after it got under way, *Coal Age* absorbed *The Colliery Engineer*, previously *Mines and Minerals*, established in 1861. It was purchased from the International Textbook Co., affiliated with the International Correspondence Schools, late in 1915.

Goals

If it bore a Hill or a McGraw label a publication in those days, as well as now, was established to render a definite and superior service to an industry or to a group of readers with common interest such as, power-plant operators. Because it serves all levels of managerial and supervisory responsibilities in its industry, *Coal Age* is classified as a "vertical" publication. In contrast, *Power*, another McGraw-Hill publication, serves power-plant men in all industries, and thus is classified as "horizontal."

Practically everybody in the business world is familiar with and uses business publications. Consequently, there is a tendency at times to rather take them for granted. But if *Coal Age* did not already exist, someone would start it, because the need for business and industry news is as old as business and industry themselves. And *Coal Age*, along with other publications dedicated to serving their industries or functional reader groups, does more than merely report developments. It studies the industry and its problems. It works with its people and participates in its discussions.



Harold Davis

Alfred E. Flowers

Daniel Jackson Jr.

Dolores Billmyer

F. Alvin Zimmerli

Serving Coal October, 1961

Harold Davis, managing editor—A native of the anthracite region, Mr. Davis started his mining career as a laborer for The Hudson Coal Co. at the Grassy Island colliery in December, 1938. He entered Penn State in September, 1941, and received the degree of mining engineer in 1947. During World War II he served from June, 1943, to June, 1946, with the Army Corps of Engineers including a year in the Asiatic-Pacific Theater, rising from the rank of private to first lieutenant. Upon graduation, Mr. Davis joined the extension staff, and for 2 yr immediately before coming with *Coal Age* was assistant supervisor of Mining Extension for Penn State.

Alfred E. Flowers, associate editor—Chief engineer for the Clinchfield Coal Corp. at the time of joining *Coal Age* in August, 1952, Mr. Flowers was born and received his elementary and high-school education in Harrisburg, Pa. He entered Penn State in 1939, and during summer vacations worked as an engineer-in-training for The Hudson Coal Co. Upon graduation in 1942, he joined the staff of the Clover Splint Coal Co., Closplint, Ky., returning to Penn State in 1946 as instructor in mining engineering and research engineer on mechanical-mining methods. While there he earned a master of science degree in mining engineering and the technical degree of engineer of mines.

Returning to the industry in 1949, Mr. Flowers joined the Clinchfield operating department as assistant superintendent of Moss mine, becoming, in 1951, mining engineer. Later he was advanced to chief engineer, holding that position until joining *Coal Age*.

Daniel Jackson Jr., associate editor—Specializing in the electrical and maintenance fields, Mr. Jackson is a native of Logan County, West Virginia, and received his electrical schooling from the Dept. of Electrical Engineering, West Virginia University College of Engineering. He interrupted training in 1943 to serve in the Navy, resuming classes in 1946 after receiving his discharge. That same year he accepted a part-time job with the Guyan-Eagle Coal Co., No. 1 mine, Amherstdale, W. Va., and began working full time in 1950. A year later he joined the staff of the Amherst Coal Co. as an electrical-mechanical inspector, Buffalo Creek Div. By 1954 he had become chief electrician of the company's Lundale mine. He then joined Winding Gulf Coals, McAlpin, W. Va., as chief electrician, in 1956, coming to *Coal Age* as assistant editor a few weeks later.

Dolores Billmyer, assistant editor—Mrs. Billmyer, who presides over the news and new products sections of *Coal Age*, received her title of assistant editor Sept 1, 1961, after assuming responsibilities for these sections with the November, 1960 issue. Mrs. Billmyer joined the *Coal Age* staff in February, 1955, as secretary to the editor and general assistant to other staff members, and in addition took over the responsibility for compiling the Buying Directory for the *Coal Age* Mining Guidebook in 1957.

F. Alvin Zimmerli, art director—A graduate of Pratt Institute, of New York, in 1927, Mr. Zimmerli came to McGraw-Hill in 1942. The intervening years were spent in editorial and advertising artwork individually and as an employee of various publications. He came to the mining publications, *Engineering and Mining Journal* and *Coal Age*, in 1945 to handle presentation of editorial material, becoming art director for both publications in 1957.

Providing general and secretarial assistance to the staff are Mrs. Bette Mintz, secretary to the editor, general assistant to staff members and compiler of the Buying Directory in the *Coal Age* Mining Guidebook, and Jodie Lessack, assistant to the art director.

Out of this study, work and discussion, as in this issue, it proposes, explains and advocates policies and practices which the editors feel will advance the interests of the industry it serves. The publication's proprietors and its staff consider its fortunes inextricably bound up with the fortunes of coal–and proceed accordingly.

World War I was not far in the future when the first issue of *Coal Age* came off the presses. And, though it, too, could not be foreseen, coal was about to meet for practically the first time heavy competition–first from oil, then hydro under the New Deal, and next natural gas in the 30s, with possibly nuclear in the future. Also, pressure for economy in coal use by the government during the war set off a campaign that–though it was and is good for coal–cost it additional tonnage that it might otherwise have enjoyed – at least temporarily.

October, 1911

But in October, 1911, the preceding problems were largely problems of the future, and the rate of expansion in demand for coal was such that no one could really quarrel with it. There was, however, then as now, the problem of excess capacity. This in turn spilled over into the field of cost since this latter was then the major weapon in internal competition between producing companies. And since labor was the major item in costs–75 to 85% of the total–and since there was a considerable tendency to try to gain a competitive advantage by adjusting wages downward, the ultimate result was that labor relations was a No. 1 problem.

Another problem was safety, particularly the carnage resulting from the scourge of mine explosions that accompanied the growth of the industry. They were frequent and since hand loading meant large working forces the death tolls were terrific.

So *Coal Age* when it started had at least three major opportunities to help with industry problems:

1. Improvement of relations between management and men.

2. Promotion of cost reduction through some other approach than wage-cutting.

3. Reduction of the terrifically high accident rate.

A fourth opportunity, which became increasingly important as the years wore on, was helping coal management attain a reasonable degree of stability in pricing practices, with the aim of eliminating the giving away of all the fruits of cost reduction and quality improvement–and even mining properties themselves–in the form of unwarranted price cuts.

Inspection of the early issues of *Coal Age*–a weekly until July, 1927 –reveal a variety of approaches to the problems previously listed, and others. In the field of labor relations, one approach, in addition to editorials, news and feature articles, was the establishment of a "Sociological Department," which ran until 1915. This discontinuance did not mean that *Coal Age* was through with the subject–rather, that the editors felt it could be handled better other ways.

The fundamental principles of good relations between management and men were well known to the early editors of *Coal Age,* and they were among the first to render a major and consistent service in this vital area. It was not until World War II, for example, that all McGraw-Hill publications began to render a similar service.

Big problems in labor relations–or little–none were exempt from the attention of the editors. For example, the Sociological Department, among other things, offered some hints on how to get along with the women folk of mine employees for the benefit of the wives of superintendents and managers. And the minor–or perhaps not so minor–problem of what to do with drunks in mine boarding houses also was analyzed. Conclusions? Much as today – first reason, then warning and then the boot, though the publication also urged that marriages be facilitated to give the roisterers something else to think about.

ABC—ABP

The editors also lost no time in beginning their services in the fields of cost reduction through improved equipment and methods, achievement of price stability, and promotion of safety through education, training and elimination of physical hazards. These three approaches are still the backbone of safety progress, incidentally.

Meanwhile, Mr. Hill and Mr. McGraw and other forward-thinking publishers of business and technical magazines were working for a principle that perhaps more than any other is responsible for the high standards of business publishing today. It was the publication of circulation figures for their magazines and their verification and audit by an independent organization. This would permit the advertiser to know, definitely and without question, what he was getting for this money. Having worked for such an organization for a number of years, Mr. Hill and Mr. McGraw promptly took their publications into it when it arrived. It was the Audit Bureau of Circulations–known in the trade as ABC–which started its vital checking of paid-circulation publications – both newspapers and magazines–in May, 1914.

While the work leading to ABC was going on the business publishers also were proceeding in another direction to insure the maintenance of high publishing standards. A conference at Niagara Falls in 1905 led to the formation of the Federation of Trade Press Associations. In May, 1914, it became Associated Business Publications–otherwise ABP.

With an independent circulation-auditing organization, ABP felt it was in position to really advance the standing of its industry. One of its first steps was to issue a Code of Ethics stating the obligation of the publisher to consider the interests of the reader above everything else, to prevent the use of editorial matter for advertising purposes, to reject misleading advertising, to publish advertising rates and apply them without discrimination, and to publish verified circulation statements. With ABC and ABP the advertiser could buy in confidence and still can.

Coal Age is proud that it is a charter member of both the Audit Bureau of Circulations and Associated Business Publications.

Wars I and II

When Wilson took the United States into World War I, *Coal Age,* with other business and technical publications, had a new job thrust upon it. The job had many facets–

dissemination of government orders and particularly explanations of their meaning and how to conform; cooperation with the industry in getting unrealistic and unworkable regulations modified or eliminated; promotion of the conservation of critical materials, including the conservation of coal itself which, in both wars, was a critical material; helping the industry achieve the most-effective use of available manpower; and so on and so on, including the vital job of maintaining morale.

Coal had its first major experience with federal regulation in World War I and the experience left both it and *Coal Age* a little skeptical of the vaunted benefits, though in agreement that the right kind of regulation is a necessity in time of war. The skepticism was reinforced by the industry's experience with government price control in the 30s, but as a result of that experience both the industry and *Coal Age* probably were a little better prepared for the much-wider and tighter controls of World War II.

In line with its basic principle of rendering all possible help to its industry, *Coal Age*, in World War II, noted the absence of any public recognition for excellence in supporting the war effort. Only one coal company received an Army-Navy "E." To fill the gap, give deserved recognition to companies and men doing a superior job, and to stimulate an even-better performance, *Coal Age*, in 1944, offered its "Coal-for-Victory Awards" in cooperation with the Solid Fuels Administration for War.

The awards were for two types of achievement: (1) an increase of 6½% in production over the previous year, and (2) an increase of 10% in tons per man. Two anthracite and 144 bituminous mines received the *Coal Age* "Coal-for-Victory Awards" in the years 1944 and 1945.

John L. Lewis

Though he had been around for some time, the year 1919 brought a new man onto the coal stage—John L. Lewis. For another 40 yr he seldom was to be far from the thoughts of either coal men or the editors of *Coal Age*. He lost no time in colliding head-on not only with industry management but also with his first President of the United States—in this instance, Wilson who, like Roosevelt in a later era, first said "No" and later through the tried-and-tested device of a special commission, gave in.

Along with operators and the government *Coal Age* gave Lewis special attention, and he is the subject of more pages in the publication than any other single individual—and they still appear. The editors of *Coal Age* were no more able than the operators to see anything but a tougher row to hoe as a result of his earlier operations, especially after the disaster which followed the forcing of the Jacksonville agreement of 1924 on the operators of the old Central Competitive Field in spite of the current depression and particularly the problems caused by the overcapacity resulting in part from wartime pressure to get coal.

Whether if Lewis had been willing to temper his demands to the economic times the industry would have had less trouble in the years to follow is a question that perhaps could be debated endlessly, but his "No backward step" approach made it difficult to appreciate the ultimate significance of such actions as his endorsement of the idea of more machines and higher productivity in his own book, "The Miners' Fight for American Standards," published in 1925. It still was difficult when Roosevelt and the NRA put him back in business in 1933 after the collapse of the union following the operator revolt against the Jacksonville agreement, and he promptly went back to his original tactics.

Coal Age found itself again, with the operators and practically everybody else, lined up against him, since it was difficult to appreciate at the time that one result would be to spur the industry on to achieving cost and other improvements at a rate much higher than otherwise would have been the situation. When the tons-per-man curve turned sharply upward in 1950, it is perhaps no coincidence that this marked the beginning of the era of peace that has lasted over 10 yr. Perhaps Lewis may have been working toward such a situation all along. At any rate, when he looks at the record he possibly can claim that he has more justification than the editors of *Coal Age* to say "I told you so."

This possibly also reflects the fact that editors, like other breeds of men, are fallible. However, when they are a part of such publishing ventures as McGraw-Hill they may claim with some justification that the failing is less pronounced. This flows from the fact that their employers, no less than themselves, insist that they know their industry, study its problems without letup, and work continuously to render concrete help.

At times it may seem that the help takes unusual forms — for example, opposing a proposal of a few years ago that the industry work for a severance tax on oil and gas. The practical reason for opposition was the certainty that as soon as the principle had been adopted coal itself would be next in line. And in 1931, at a time when officially, at least, the big majority of the bituminous industry was against unionism, *Coal Age* came out for it as one step to the attainment of stability.

Stabilization

Stabilization was perhaps the dominant thought in all operator minds as the 20s ended and the 30s began. The hard times following World War I, with the added complications of excess capacity, the rise of competition and the revolt against the Jacksonville agreement, resulted in an era of price-cutting unmatched before or since in industry history. Desperate operators were looking for any and all avenues of escape, including, among others, fair-practice codes and the adoption of state and federal legislation to prohibit loss selling.

Coal Age, as previously noted, had its doubts about the blessings of government regulation, as it still does, and advocated, among other things, that management take the simple, yet difficult, step of not mining coal unless it could sell it at a fair price. And among other measures for stabilization offered in its September, 1931, issue, it included this statement:

"The conclusion seems inevitable that the desired stabilization of wages and of working conditions must come through a recognition and an acceptance of an outside labor organization by a sufficiently large percentage of the operators to give the wages and working conditions so

established a controlling influence in the districts where direct recognition is withheld."

Perhaps the basic logic of the recommendation could be credited with the relatively calm acceptance of the union when it was put back in business by the National Recovery Act of 1933. The second Guffey, or Bituminous Coal Act of 1937, provided an added degree of stabilization, but at the expense of growing government control of coal operations. The fact that there were only a few mourners when the Act was permitted to expire in 1942 represented industry acceptance of the view also held by *Coal Age* that the less government in your business the better.

Negotiation Reform

It was difficult to keep the government out of business during World War II, though *Coal Age* maintained then and still does that both unfairness and sheer interference for the sake of interference motivated some actions. The seizures, for example, still stand as outstanding examples of penalizing the innocent party—management and owners—for failing to do something they were forbidden to do by both law and regulation.

The seizures also reflected the continued failure of the union and management to reach common ground on mutual problems. One reason, in the view of *Coal Age*, was the deficiencies in the industry bargaining setup—primarily the lack of a spokesman with authority to take action without the cumbersome and usually futile necessity of checking with principals at every turn.

The *Coal Age* campaign for such a setup culminated in its personal opinion poll, the results of which were published in April, 1949. Of the eight proposals offered for vote, all were approved—six overwhelmingly. One of the six was granting broader powers to negotiators. There seems little question that the publication of this report helped convert growing sentiment in the industry into action resulting in, among other things, organization of the Bituminous Coal Operators' Association late in 1950—the start of a new relationship between management and union that has resulted in peace and growing cooperation since that time.

Mining and Safety

Perhaps as much as anything else, the *Coal Age* editors like to take satisfaction in their support of the use of machines to cut cost, heighten quality, promote safety, and improve the industry's competitive position. Machine mining and stripping, and improvement in methods involving them, have been the subject of literally thousands of pages in the 50-yr history of the publication. In the 20s and 30s it was almost literally true that the installation of loader or shovel was followed in short order by a visit from a *Coal Age* editor intent on analyzing and reporting on the results of its use.

The editors still follow the trends and make many property visits, witness the steady stream of reports that continue to appear in the pages of the magazine. A big part of the 75,000 to 85,000 mi racked up by the editors per year represents on-the-job studies of new or better-than-average stripping, mining, preparation and safety installations.

Service in these and other respects includes, in addition to the usual features, such special or extraordinary issues as the following:

The Coal Age Model Mine Issues—single annual issues dealing exhaustively with the operations of one company or a single mining region. The first appeared in 1921 and the series ran 20 yr until 1941 and the onset of the war.

The Coal Age Mining Guidebooks—inaugurated in 1955 and based on the principle of providing in one issue each year the fundamentals on which good practice must be based, supplemented by a roundup of the best in current equipment and methods.

Various types of special issues in the interim between 1941 and 1955 included five specifically devoted to higher productivity, better preparation and greater safety: "Modern Coal Production Number," April, 1944; "Mining Efficiency Number," May, 1946; "The Coal Mines of Tomorrow," June, 1948; "New Mining Horizons," July, 1950; and "Designs for Modern Mining," July, 1952.

Today, among other extra features, *Coal Age* offers its Operating Guides. Subjects covered so far have been: "Mine Storage of Coal," December, 1959; "Coal Screens and Screening," April, 1960; "Cutter and Drill Bits," September, 1960; "Belt Conveyors and Belting," December, 1960; and "Lubricants and Lubricating Equipment," May, 1961. Future Operating Guides will cover fine-coal treatment and water handling, bearings, electrical cables and connectors and hydraulics and hydraulic fluids.

The fact that *Coal Age* throughout its career has provided cups for the winning first-aid and mine-rescue teams in the National First-Aid and Mine-Rescue Contests is one evidence of its interest in the promotion of safety in coal mining. That flame of interest burns as brightly as ever, and *Coal Age* along with other honors, has consistently received the Public Interest Awards of the National Safety Council since the first in 1953. But thousands of pages of editorial material over the past half century are perhaps the best evidence of all of its concern with safety.

A basic principle in *Coal Age's* approach to the matter of safety has been emphasis on the importance of individual conviction and action. *Coal Age* has always maintained that letting George—in this case management—do it, or trying to attain it by passing laws, does not get at the root of the matter, which is that every individual must accept personal responsibility and proceed accordingly.

The Unusual

If *Coal Age* can be credited with having made marks, it has made them in unusual as well as usual ways. For example, the almost-universally-used term, "bridge conveyor," was coined by a *Coal Age* editor confronted with the job of coming up with a substitute for a registered trade name. It first appeared in *Coal Age* in August, 1950. "Ropeframe," one of the commonly used designations for this type of conveyor, also was coined for the same reason.

But *Coal Age* cannot always count on success. For years, it has been attempting to codify some of the mining language by trying to get the term "heading" used to mean one single opening of an "entry" made up of several headings. But since

even the editors slip, it must be concluded that in some things the old ways will persist and "entry" will continue to be used to mean both one heading or a whole group of headings.

All the 21

Whatever may affect coal—for good or ill—is grist for the *Coal Age* mill, and the interest and intent of the editors, and their desire to render the maximum in service, is reflected in the fact that to make their efforts bear maximum fruit for the reader they proceed on the findings of a careful analysis of the industry's informational needs. Thus, they are better able to keep on the right track—with the help of periodic surveys among readers to check on problems and requirements. Many readers no doubt can recall being addressed in such surveys.

With the most-recent modifications, the guide which the *Coal Age* editors use in developing the material they offer their readers embraces 21 functions, as follows:

1. Mining methods.
2. Machine loading and continuous mining.
3. Face preparation.
4. Transportation and hoisting.
5. Roof control.
6. Ventilation.
7. Pumping and drainage.
8. Stripping and augering.
9. Preparation.
10. Refuse disposal.
11. Electrification.
12. Maintenance.
13. Supplies and supply handling.
14. Communication and communication equipment.
15. Employee-union relation.
16. Safety.
17. Supervisory skill.
18. Top-management principles and methods.
19. Promoting coal use.
20. Better merchandising.
21. Public relations.

The Road Ahead

None of the preceding material in this brief account of *Coal Age* and coal is meant to imply that the coal industry has progressed only because *Coal Age* was around. Far from it. The many, many thousands of men who have given of their time, talents and fortunes over the years would stand against such a claim even if *Coal Age* had the temerity to make it. But it can be said that in *Coal Age* the coal men of yesterday—and of today and tomorrow as well—had—and have—a source of news of industry happenings, of suggestions and programs for improvements, and of inspiration and encouragement developed specifically to ease their task.

At this time, as brought out in other features in this Golden Anniversary Issue marking 50 yr of service to the coal mining industry, *Coal Age* is convinced that a new era of growth lies ahead. Documenting this belief is, incidentally, another service and here, too, the editors offer their best judgment and, resting on that premise, are willing to submit their findings to the sternest of scrutiny. But while there is difference as to how high the tonnage will go, there is now general agreement that the years ahead will be active and rewarding years of progress.

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Stainless Steels are specified because they hold up longer. In vibrating screens, chutes, liners, and mechanical parts, corrosion and abrasion take a terrific toll of ordinary metals. Repairs are costly and take time. Stainless Steel parts resist corrosion, abrasion and abuse. Fine wet coal doesn't stick to Stainless—it's "free-flowing." Cleaning is simple since there is no build-up of corrosion. So both production and profits stay up with Stainless.

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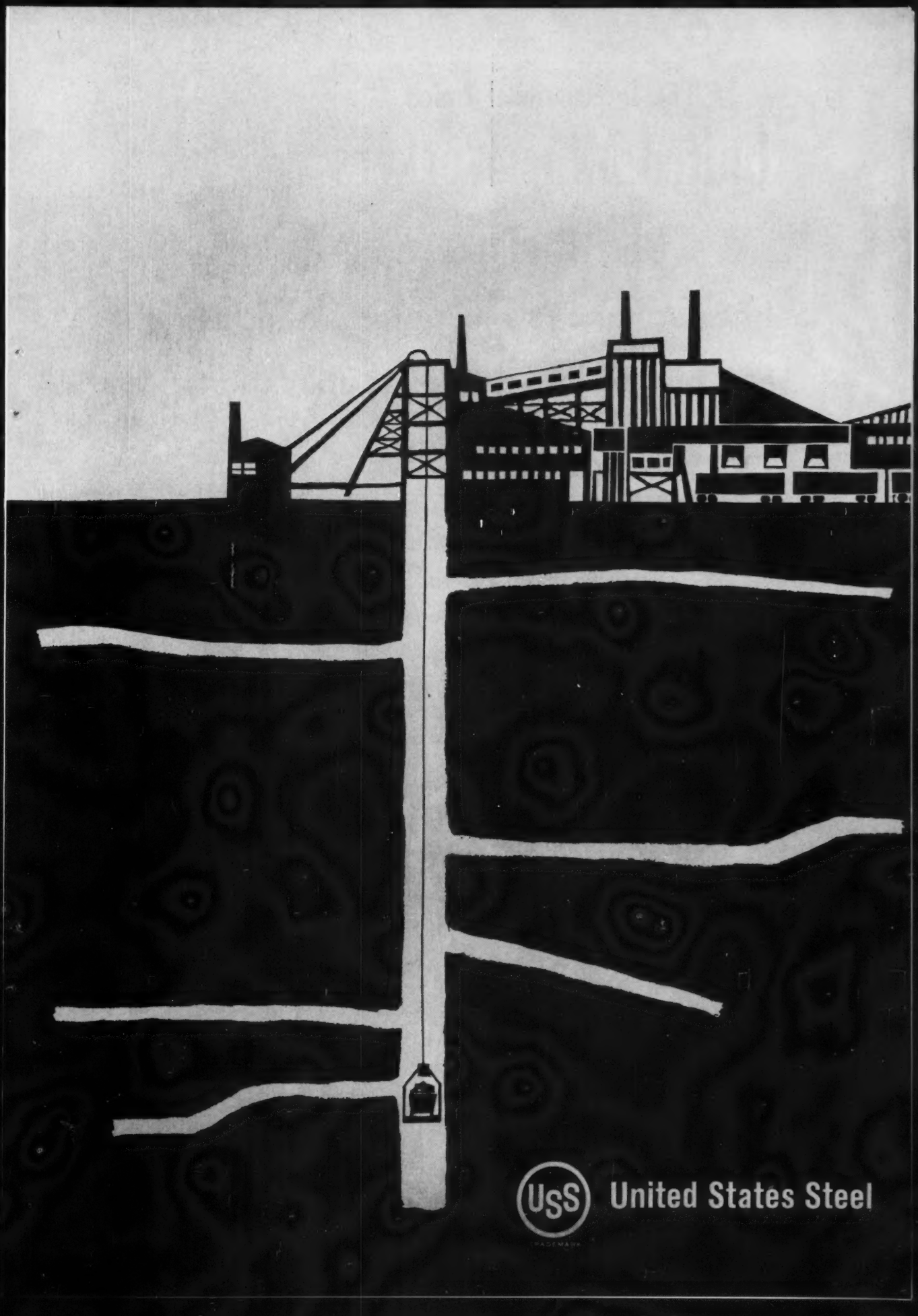
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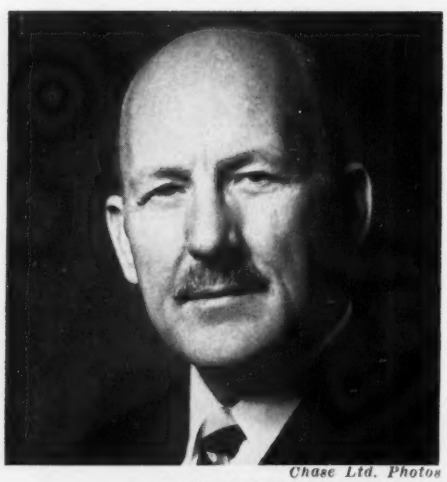

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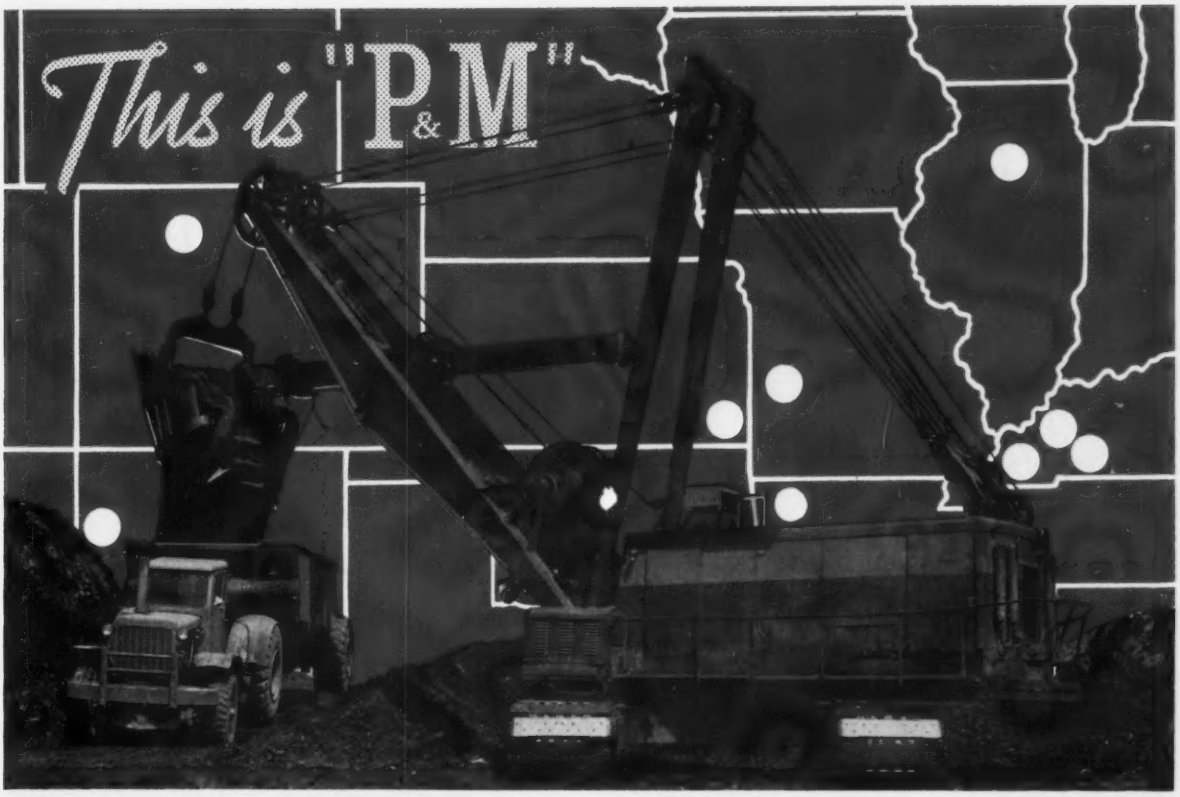
Secretary-Treasurer



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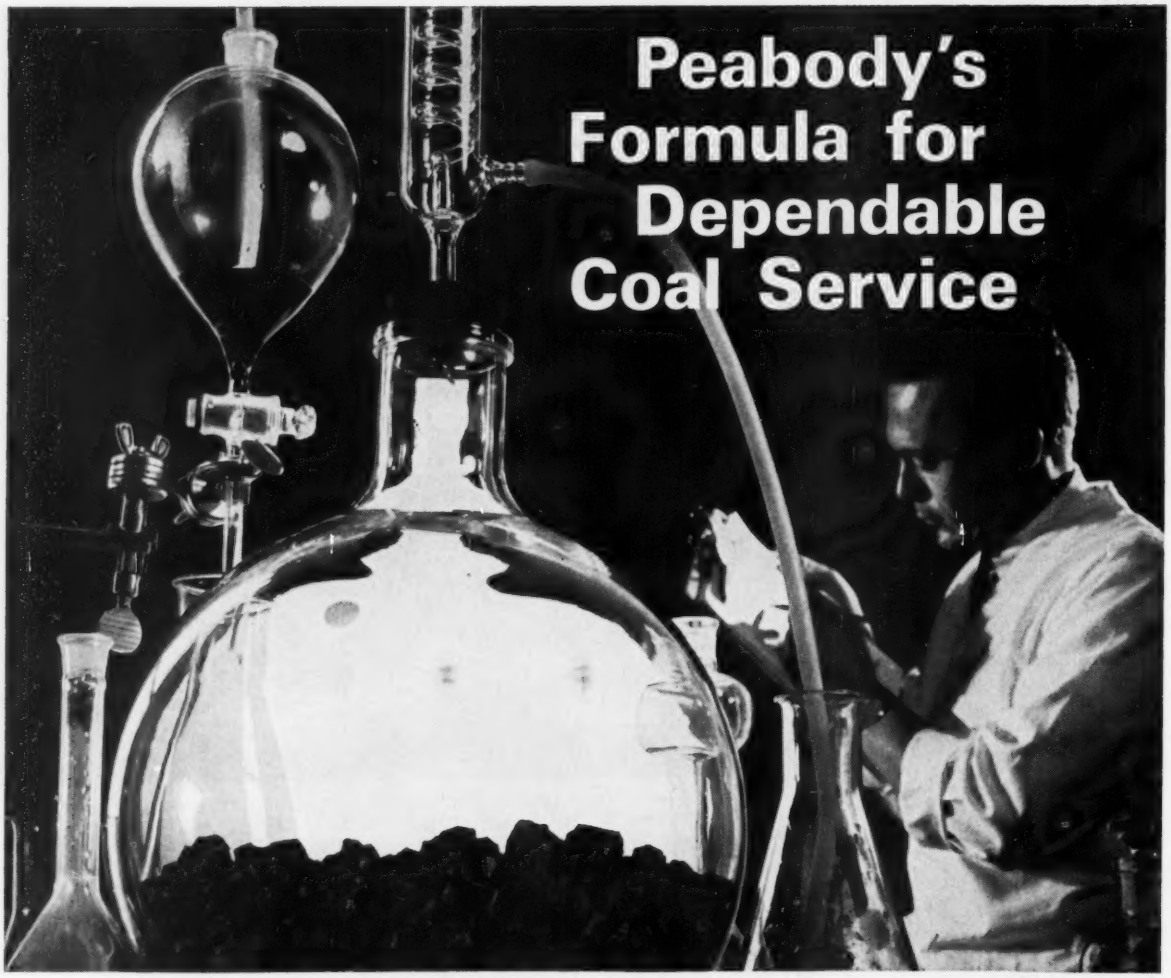
DIVISION SALES OFFICES: Denver, Colo.: 522 University Bldg.; Minneapolis, Minn.: 1706 Foshay Tower; Louisville, Ky.: 664 Starks Bldg.; Galesburg, Ill.: 202 Hill Arcade Bldg.; Milwaukee, Wisc.: 735 North Water St.

MINES: Sturgis, Ky., Drakesboro, Ky., Madisonville, Ky., Appleton City, Mo., Russellville, Ark., Hallowell, Kans., Allendale, Ill., Steamboat Springs, Colo., Gallup, N. M. (1962).



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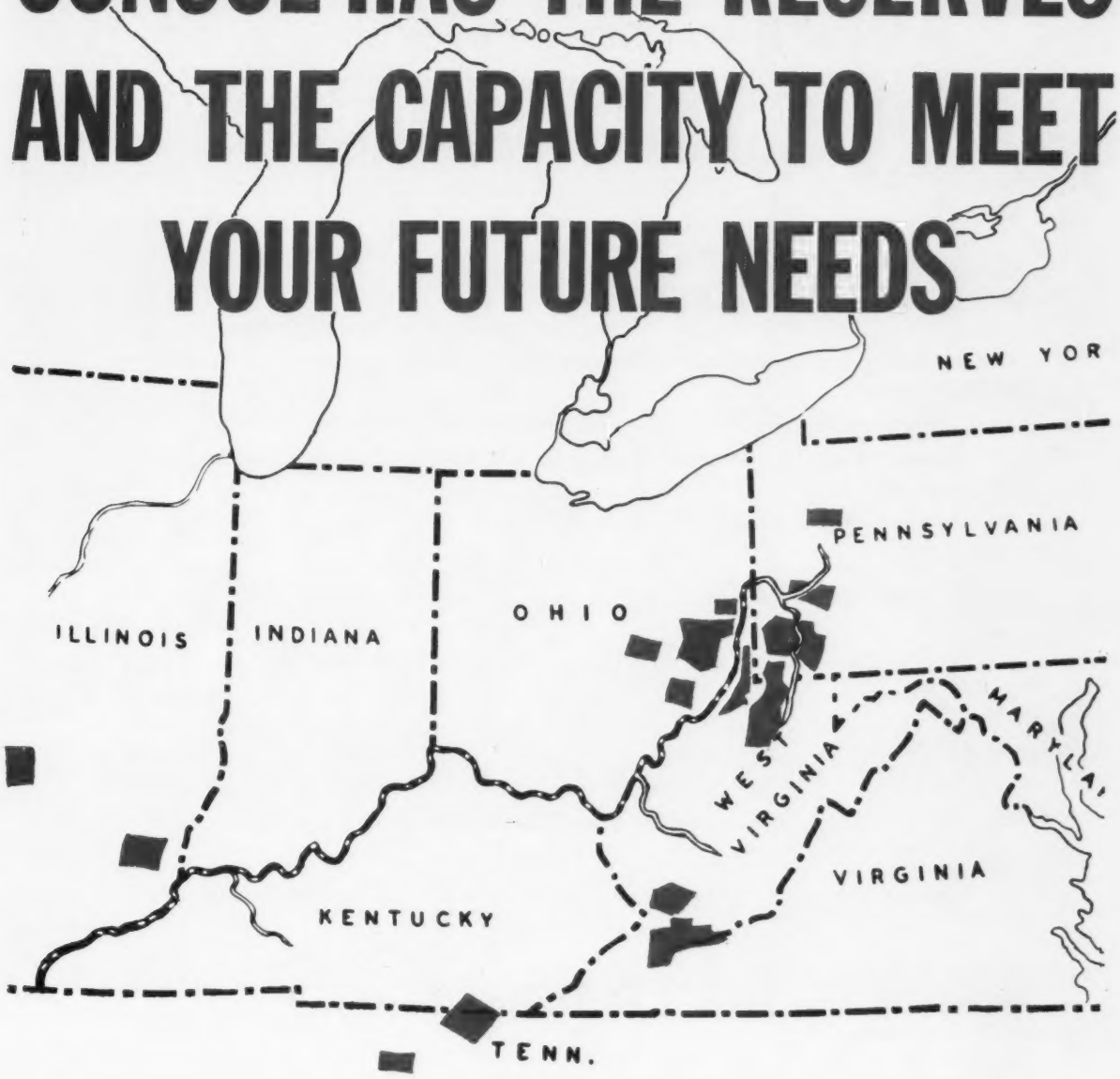

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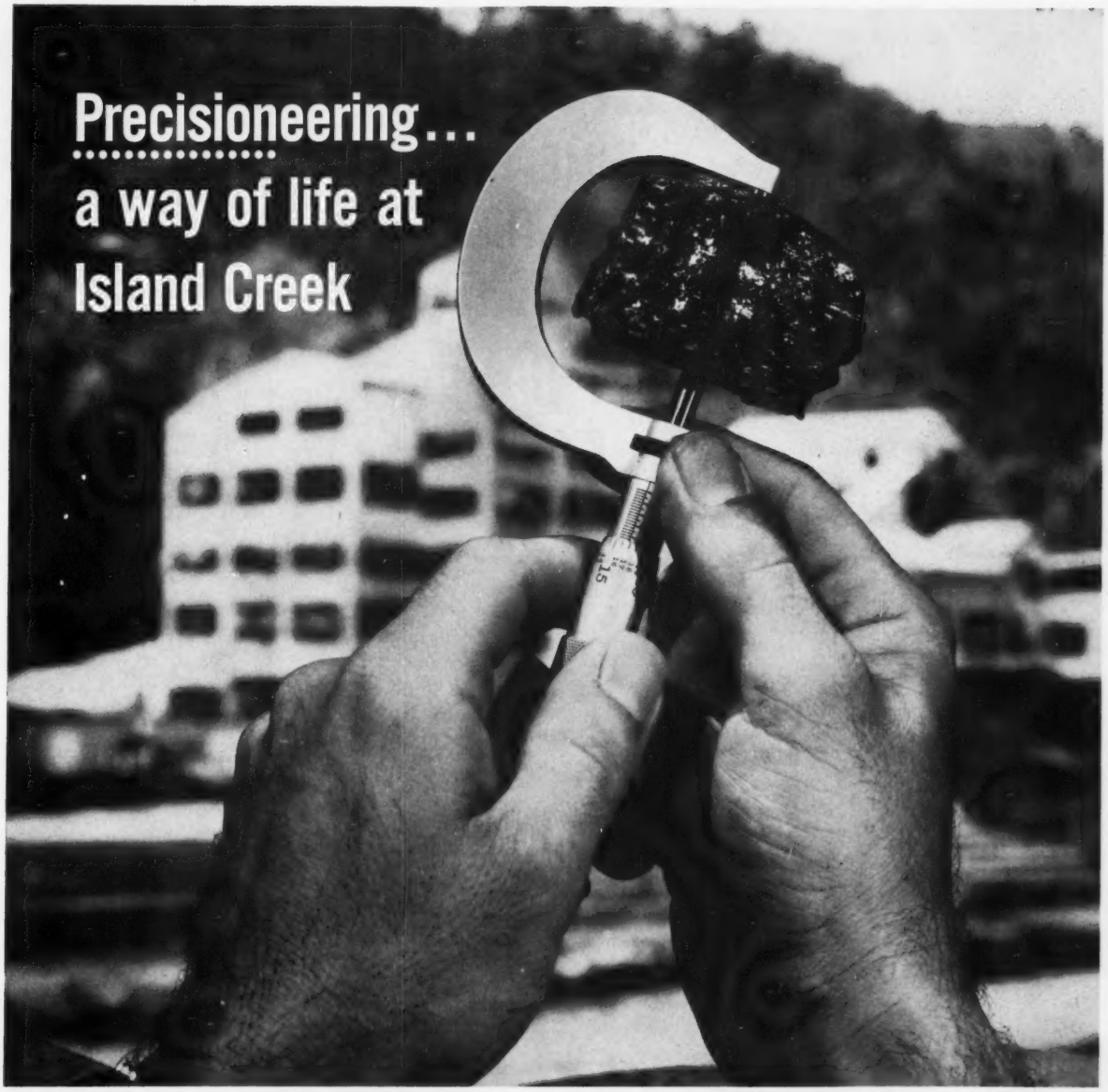

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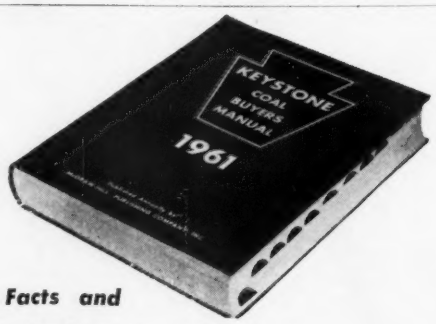

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Coke Plants—By states, showing company, executives responsible for fuel, locations, number and type of ovens, grades sold, coke and coal capacities, % L.V. coal used.

Electric Utility Generating Plants—By states, showing company, executives responsible for fuel, locations, 1960 fuel consumption, generating capacity and expansion. Projections of fuel use, 1961-2-3-4-5.

Portland Cement Plants—By states, showing company, executives responsible for fuel, locations, capacity, fuel consumption, planned expansion.

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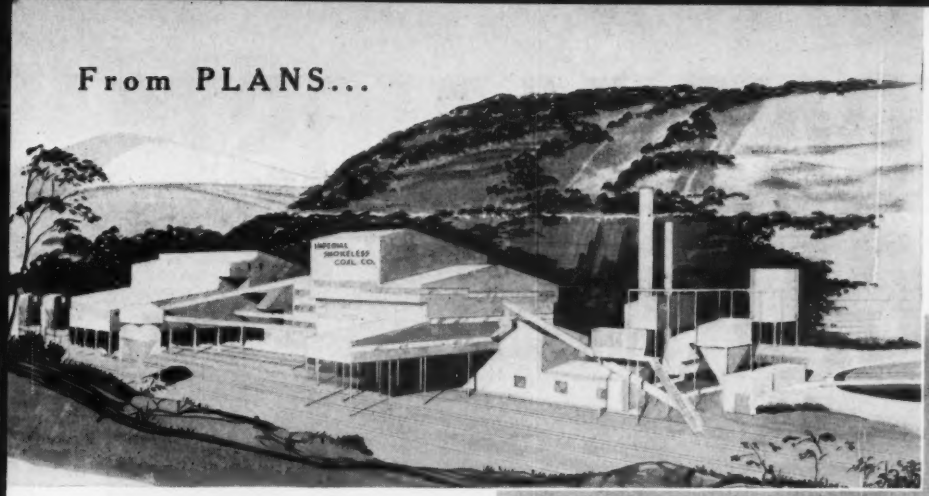
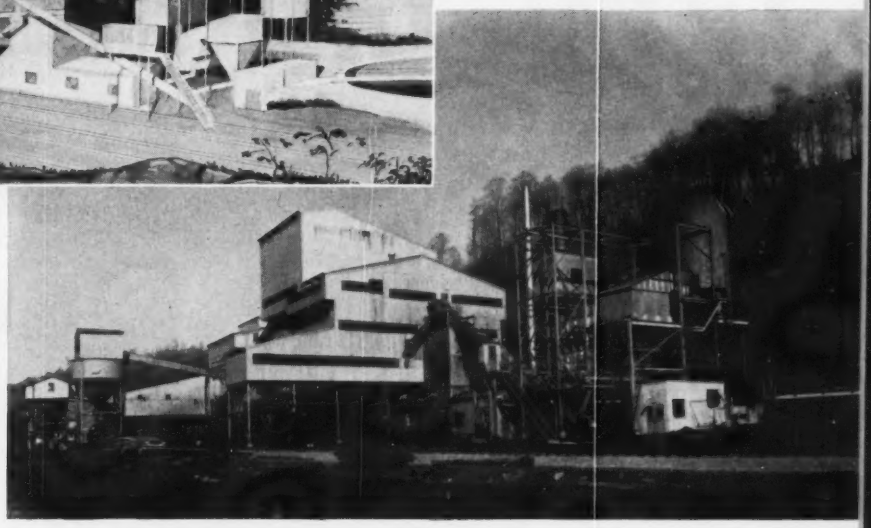
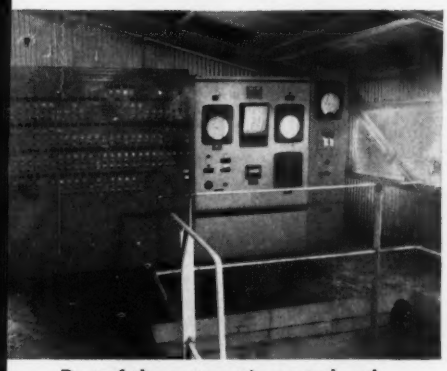


...to

PRODUCTION





Part of the automatic control and recording equipment.

In mid-1960, plans were completed and construction begun to provide the most advanced and thorough preparation possible for Imperial Quinwood coal. Less than a year later these new facilities were in full operation and now provide —

Processing and loading coal at 600 tons per hour.

Fluid medium cleaning of all sizes by a combination of a 3-compartment 8-cell jig, twin heavy media separators, double-banked wet tables, and froth flotation.

Rinsing and dewatering, and rescreening to maintain size uniformity.

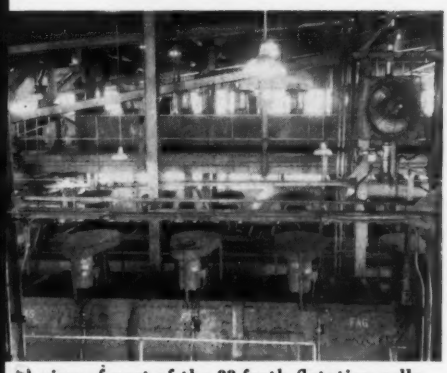
Thermal drying capable of removing 27 tons of water per hour.

Automatic and continuous sampling for accurate laboratory reports of quality.

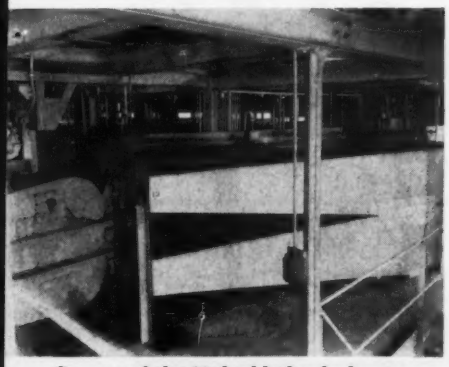
Special conveyor systems for the separation or combination of sizes as required by the customer.

Modern electronic devices for controlling and recording the operation of all this precision equipment.

The successful completion and operation of this new plant makes Imperial Quinwood coal a modern product for modern needs.



A view of part of the 22 froth flotation cells for double-cleaning the 35 mesh by zero coal.



One set of the 13 double-banked wet tables cleaning 250 tons per hour of ¼ inch by 35 mesh coal.

C. H. SPRAGUE & SON CO.

125 HIGH STREET
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Area code 617 Liberty 2-7807
Cable: SPRAGUE

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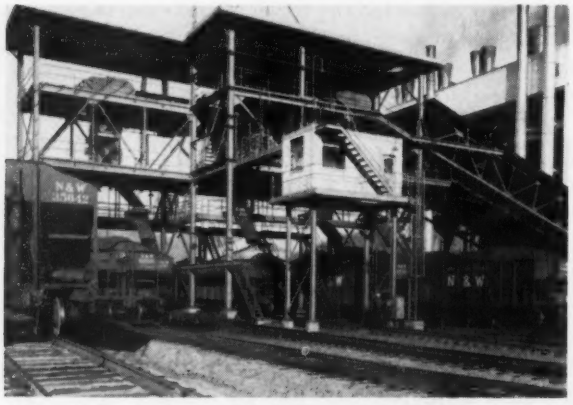
Cable SPRAGCOAL

Serving Customers in 41 different States and Countries

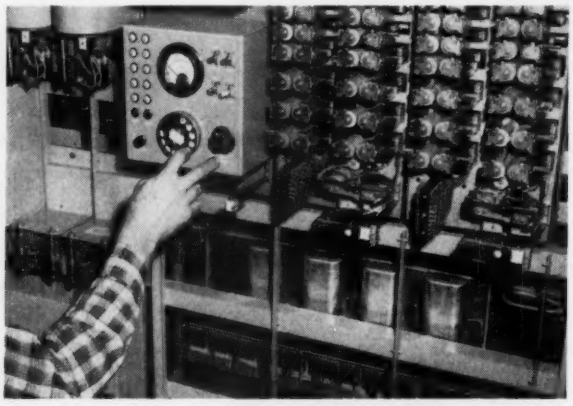
AMERICA'S "4-MOST" COAL CARRIER!

Most modern fleet of diesel locomotives in the industry to increase efficiency and speed coal shipments.

Most coal carrying capacity of any major U. S. railroad to help assure prompt delivery of shipments.



Most bituminous coal originated by any railroad, to give you a wide and varied selection of fine coals.



Most complete long-distance, direct dialing, privately operated phone system for fast in-transit reports.

CALL ON ANY OF THESE N&W COAL TRAFFIC OFFICES

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N&W Coal Traffic Dept.
Telephone Diamond 4-1451
Ext. 3313, 423, 3249, 3732
Roanoke, Virginia

BECKLEY
Raleigh County Bank Building
Telephone CLifford 2-6421
Beckley, West Virginia

BOSTON
833 Chamber of Commerce Building
Telephone LIberty 2-2229
Boston 10, Massachusetts

CHICAGO
660-664 Marquette Building
140 S. Dearborn Street
Telephone RAndolph 6-4634
Chicago 3, Illinois

CINCINNATI
913 Dixie Terminal Building
Telephone DUnbar 1-1325
Cincinnati 2, Ohio

CLEVELAND
Room 722,
The Illuminating Building
Telephone MAin 1-7960
Cleveland 13, Ohio

DETROIT
1514 Book Building
Telephone WOodward 1-2340 or 1-2341
Detroit 26, Michigan

NORFOLK
Terminal Building
Telephone MAdison 7-7481
Ext. 131
Norfolk, Virginia

PITTSBURGH
1112 Oliver Building
Telephone COurt 1-1468
Pittsburgh 22, Pennsylvania

ST. LOUIS
2059 Railway Exchange Building
Telephone MAin 1-1180
St. Louis 1, Missouri

WINSTON-SALEM
1105 Reynolds Building
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Winston-Salem 1, North Carolina

N&W

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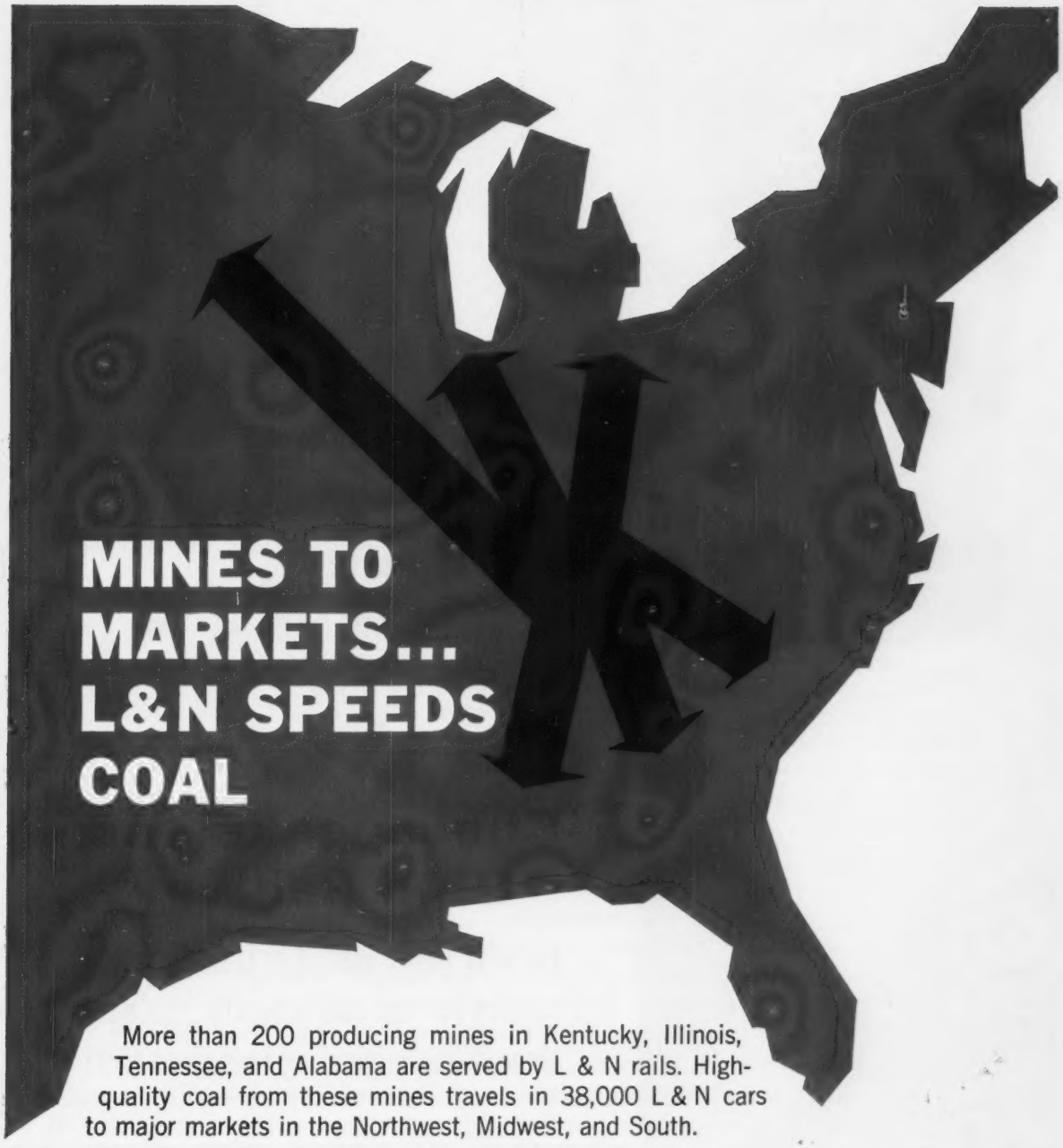


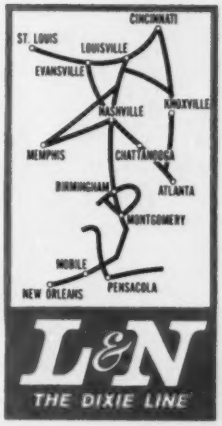
MINES TO MARKETS... L&N SPEEDS COAL

More than 200 producing mines in Kentucky, Illinois, Tennessee, and Alabama are served by L & N rails. High-quality coal from these mines travels in 38,000 L & N cars to major markets in the Northwest, Midwest, and South.

A big job: 25% of all U.S.-mined coal handled through retail dealers comes from Dixie Line territory. As one of the four largest coal-originating railroads, L & N hauls a growing volume which amounted to 32 million tons last year.

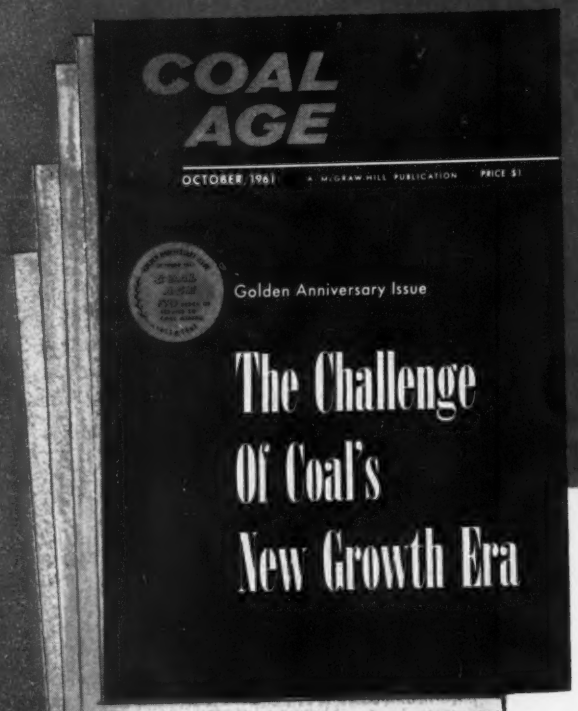
A big job done efficiently! This year, L & N has added to its fleet 1,350 new-design coal-hopper cars . . . part of a continuing program of car, track, yard, and terminal modernization that assures coal shippers and users of the most advanced transportation in the land.

See L & N first for coal . . . quality coal of all grades, in the right tonnages, on the right delivery dates! *Write or phone Coal Traffic Dept., Desk C. A., Louisville and Nashville Railroad, Louisville 1, Ky. (JUniper 7-1121).*



L&N
THE DIXIE LINE

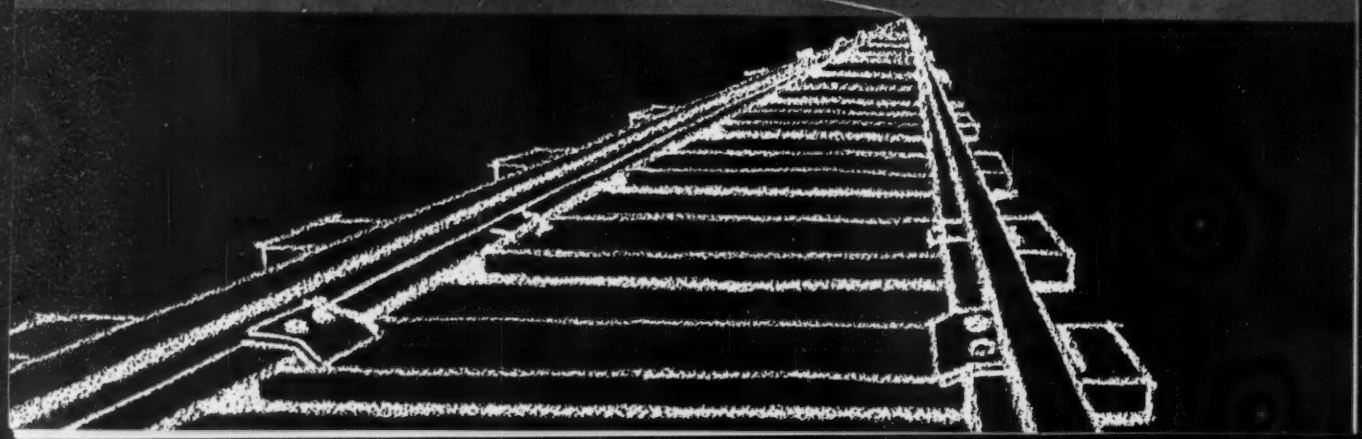
LOUISVILLE AND NASHVILLE RAILROAD



For fifty years a leading source of technical information for the coal industry . . . thirteen million copies since 1911!

Chesapeake and Ohio Railway

For fifty years, leading in transportation service for the coal industry . . . almost three billion originating tons since 1911!



Du Pont reports on

a new type of conveyor belt carcass

that sets new standards of performance

Made with load-bearing components of DACRON® fiber, it resists deterioration better, carries more, cuts handling costs

Today, a new type of conveyor belting offers you cost-saving performance on the toughest jobs in industry. The reason is a fabric carcass made with strong reinforcements of "Dacron"* polyester fiber running the length of the belt.

Superior resistance to deterioration—"Dacron" is not affected by rot and mildew, so these belts do not have problems with moisture in cover cuts, or when fabric is exposed in the splice area. "Dacron" also withstands belt-fastener rust and most chemicals to assure long service under tough, wet or dry operating conditions.

Improved durability—Impact resistance is excellent. The high strength of "Dacron" teams up with the strength and elasticity of nylon, the cross fiber, to sustain shock loads. "Dacron" resists stretch. This means lower growth of the belt in service—fewer take-ups.

Better flexing and troughing—Because of this high-strength carcass made with "Dacron", these belts can be thinner, permitting the use of smaller-diameter pulleys. They are more flexible, train better on idler rolls—resulting in less belt wander and edge wear. These belts have a better resistance to flex failure—an important long-life feature.

Troughing up to 45° is possible, compared to the usual 20°. This means belts can be narrower and lighter—and still carry larger loads. The result is reduced handling costs right down the line!

More for your belt dollar—It all adds up to superior performance and the economy of long service with fewer belt replacements, less down-time, lower maintenance costs. Make sure you ask about conveyor belts made with "Dacron" polyester fiber next time you order—get the most for your belt dollar!

E. I. du Pont de Nemours & Co. (Inc.), Textile Fibers Dept., 191 South Main St., Akron 8, Ohio.

*Du Pont's registered trademark for its polyester fiber.

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Better Things for Better Living
... *through Chemistry*

DACRON® *polyester*
the conveyor belt fiber

Enjoy the "Du Pont Show of the Week"—Sunday Nights, NBC-TV

You get all these advantages with the new

Lee-Norse CM32

- "TOUCH AND GO" VERTICAL ACTION TRAMS LOW, CUTS HIGH
- MORE POWER — THREE 50 hp MOTORS, AC or DC (75 hp motors also available)
- LOWER — 32 INCHES HIGH
- FASTER — UP TO 80 FPM
- HEAVIER — 27 TONS
- CUTS THE DIAMOND PATTERN

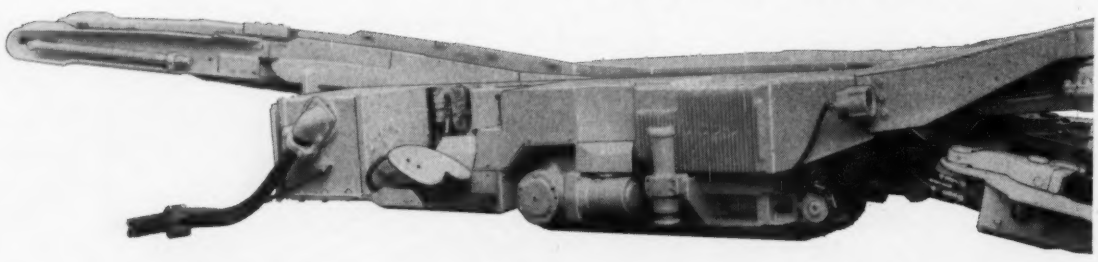
. . . the CM32 provides these benefits

The Lee-Norse CM32 MINER is designed to mine coal selectively from medium seams, ranging from 36″ to 68″ in thickness. Selective mining assures cleaner coal and reduced cleaning costs.

Low tramming and high cutting features increase coal production at extremely low operating costs.

Free-cutting action in a diamond pattern continuously gives uniformly coarser raw coal. The percentage of ¼ x 0 equals that for conventional mining, while per-

The CM32 is 32″ high, cuts coal from 36″ to 68″.



Coal High or Low . . . Lee-Norse MINERS keep production on the go!

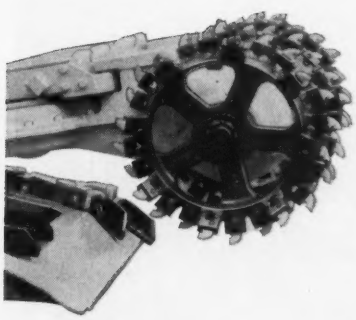
"Low Coal" MINER

The business end of the CM32 shows placement of cutters to provide a diamond pattern. Note dual gathering arms of gathering head, and large throat opening of conveyor.

centage of ⅛ x 0 is generally about 2 per cent less. Ash content of ½ x 0 fraction has been proved to be less than that mined by other methods.

The use of parts proved and tested in larger machines assures less maintenance, fewer replacements; this means low maintenance cost and less downtime.

Coal production runs high, with profits at a new high level.



SEND FOR BULLETIN NUMBER LN 612

LN *Lee-Norse Company*

CHARLEROI, PENNA.

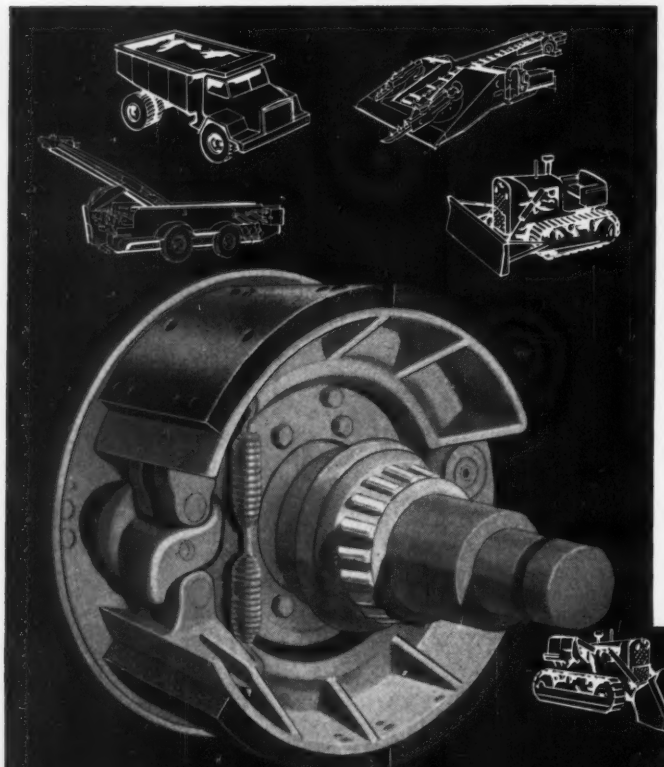
Specialists in Coal Mining Equipment

Insist on

Velvetouch Feramic®

all-metal brake blocks, clutch plates and facings

for all types of mine equipment

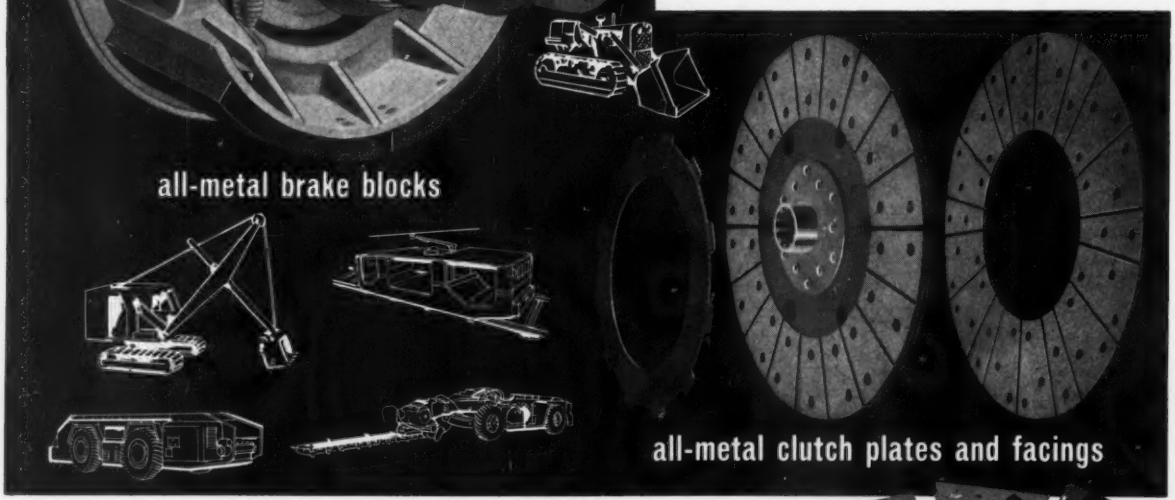


On heavy-duty coal trucks, tractors, mine equipment of all types, Velvetouch Feramic all-metal brake blocks permit faster operating speeds with greater safety.

They brake best where others fail . . . eliminate heat and water fade . . . stop high speed and downhill fade. Priced competitively with best grades of asbestos, they give longer drum life and lower cost per mile.

And . . . Velvetouch Feramic clutch plates and facings give superior service in practically every make of mine machinery for strip or deep work. They last 2 to 3, even 4 or 5, times longer than ordinary materials . . . improve clutch performance . . . stop slipping and chattering . . . reduce adjustments and downtime . . . cut maintenance costs.

When you need replacement brake blocks, clutch plates or facings, specify Velvetouch Feramic. Available from all leading equipment dealers, mine supply houses and industrial parts distributors. A-5566A



THE S. K. WELLMAN COMPANY
Bedford, Ohio

In Canada: The S. K. Wellman Co. of Canada, Ltd.,
208 Bartley Drive, O'Connor Depot,
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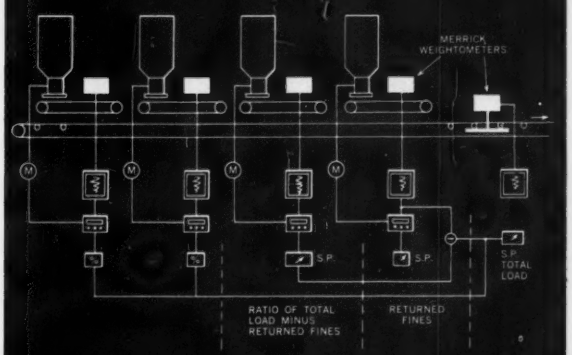
Write for literature, listing equipment for which you need Velvetouch Feramic.

For precision blending of bulk materials AUTOMATICALLY...

Here's how Weightometers can automate a typical blending system . . .



Loading is made at the set-point station, which imposes an output voltage signal to all ingredient control stations. All materials are controlled to a percent of the total load required. Recoverable material set-point is determined by returned product available. Feed is controlled by difference of returned material and total load of master set-point.

Merrick

WEIGHTOMETERS®

not only weigh and record the amount of material passing along a conveyor, they can be used to automate complete production systems. The blending system diagrammed above is typical. Integrating and recording arrangements can be electronic, mechanical or electro-mechanical.

Write us today for complete information.

Merrick

more than fifty years of "firsts" in automatic weighing

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Your underground machinery stays on the job with Kelly Quality Repair Parts

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Am I glad...
BILL'S COMPANY INSTALLED
MOORE LOCKERBASKETS!
Bill's work clothes and the clothes he wears to and from the plant are cleaner and fresher now — with lockerbaskets they're exposed to moving air and light, no more damp, musty locker odors. Lockerbaskets save space and money, too! Get all the details by writing Department A.
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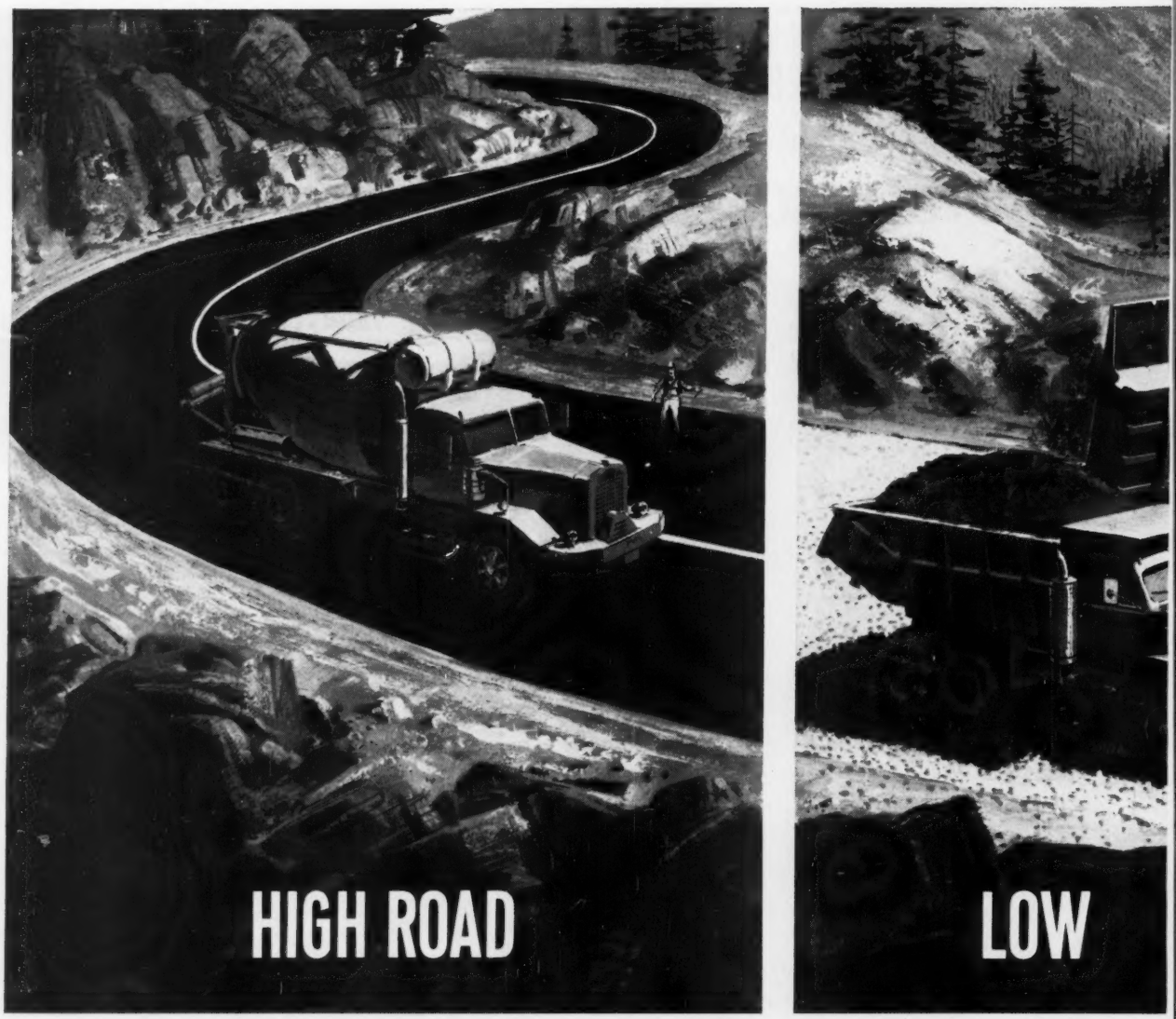
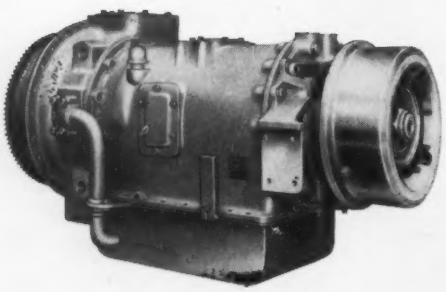


NOW A LIGHT-HEAVYWEIGHT TORQMATIC

Weighs only 985 lbs.—measures a scant

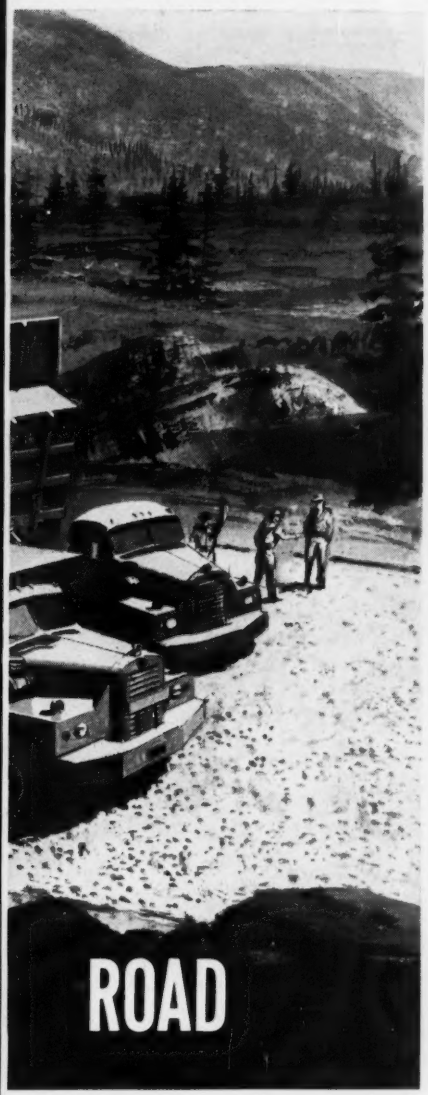


Now you can get all the savings of a power-shift hydraulic transmission in your 18-22 ton end dumps, 13-15 yard bottom dumps, 12-15 yard scrapers, big transit mixers and heavy-duty specialized equipment in a single lightweight, compact package.

The CLBT-4460 TORQMATIC DRIVE gives the driver complete control of the speed ranges throughout the work cycle, weighs only 985 lbs., measures only 40″.

With 6 speeds forward and 1 reverse, this converter-transmission team can be either remote- or direct-engine mounted. Lock-up clutch, hydraulic retarder, straight-through output and 1.42:1 step gear ratio are standard—options include four different PTO locations, transfer gear output, drum-type parking brake and 1.32:1 step gear ratio.

Want to know more about the CLBT-4460 for the crash trucks, fire trucks, snow plows, logging trucks and other equipment you're planning to buy or build? Mail the coupon today.



DRIVE THAT'S RIGHT FOR ALL THREE

40"...fits 200-300 h.p. equipment

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TORQMATIC® DRIVES

THE WORLD'S MOST COMPLETE LINE OF HYDRAULIC DRIVES

Over 980 Models used by 108 Manufacturers in
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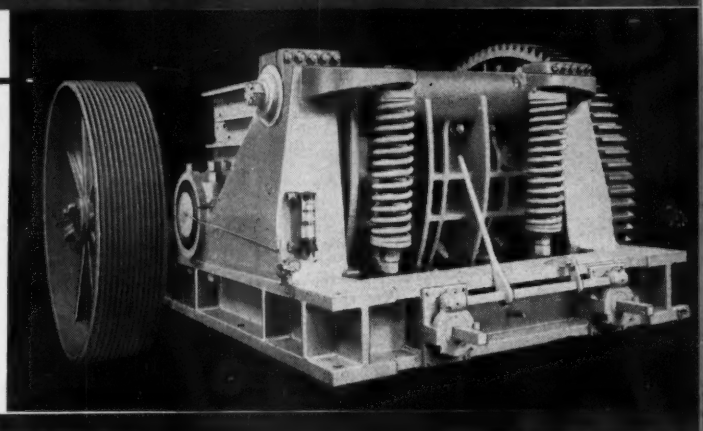
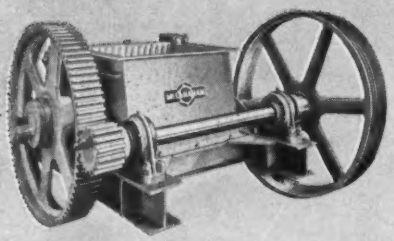
SINCE 1880

ROCKMASTER

World's Most Powerful Single Roll Crusher

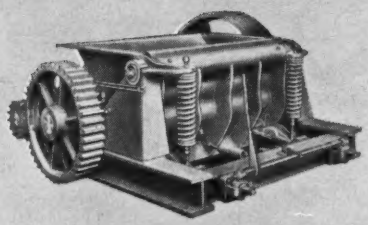
Widely used for crushing rock, slate and other mine refuse, Rockmasters have great strength for economy and extremely long service in the coal industry's most severe crushing applications. Steelstrut Toggle automatically releases tramp iron, while Quick-Adjustment controls size ranges.





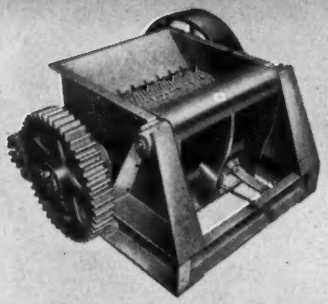
SUPER BLACK DIAMOND

Providing most Rockmaster features at moderate cost; single roll unit suitable for slate, shale, slag, mine refuse—effective in all but the most severe hard-rock operating conditions.



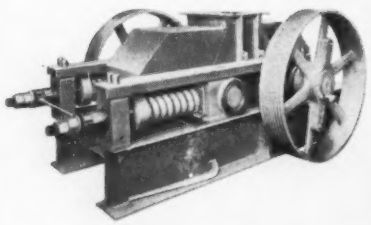
BLACK DIAMOND

A strong, durable, all-steel single roll construction—intended for reducing fairly clean coal or that containing a moderate amount of friable refuse.



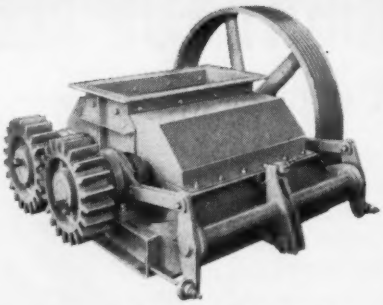
BANTAM BUSTER

Portable, economy single roll, with a high ratio of reduction; designed for trouble-free maintenance, built for crushing clean coal.



HEAVY-DUTY DOUBLE ROLL

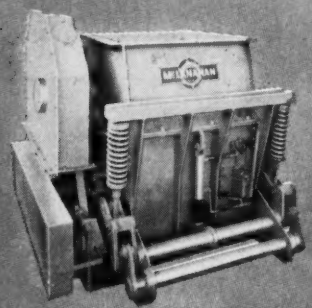
Extremely powerful, rigidly constructed—a companion to Rockmaster or Super Black Diamond on the most severe secondary reductions applications.



BLACK DIAMOND DOUBLE ROLL

Designed as a companion for crushers in the Black Diamond and Bantam Buster Class—a very economical unit for secondary reduction of fairly clean coal.

TWO-STAGE TRIPLE ROLL



Two crushers in one—a single-drive unit which reduces run-of-mine coal to fine sizes, always with a minimum of fines.

Technical Literature Available on All Crushers

McLANAHAN Corporation

HOLLIDAYSBURG, PENNSYLVANIA

Pit, Mine and Quarry Equipment Headquarters Since 1835

A FULL CYCLE

FASTER, MORE OFTEN WITH A 1205

The ability to dig in and get out *fast,* with a profitable payload on every cycle, has made the 1205 a coal field favorite. It's quick to respond under all digging conditions. With 3 or 4 yard bucket, 60 to 170 feet of boom you get the capacity and range needed to move more tons per shift.

A 90% power assist on big main drum clutches provides finger-tip control, yet gives the operator positive feel of the load. Engaging speed is automatically controlled to cushion shock and impact loading, protect cable.

Revolving fairlead turns 360° — maintains true cable lead at every pull angle on bucket. Only two sheaves — large diameter — prevents sharp reverse cable bending, provides longer cable life.

See your distributor or write for bulletin!

KOEHRING MEANS HEAVY-DUTY

KOEHRING
DIVISION OF KOEHRING COMPANY
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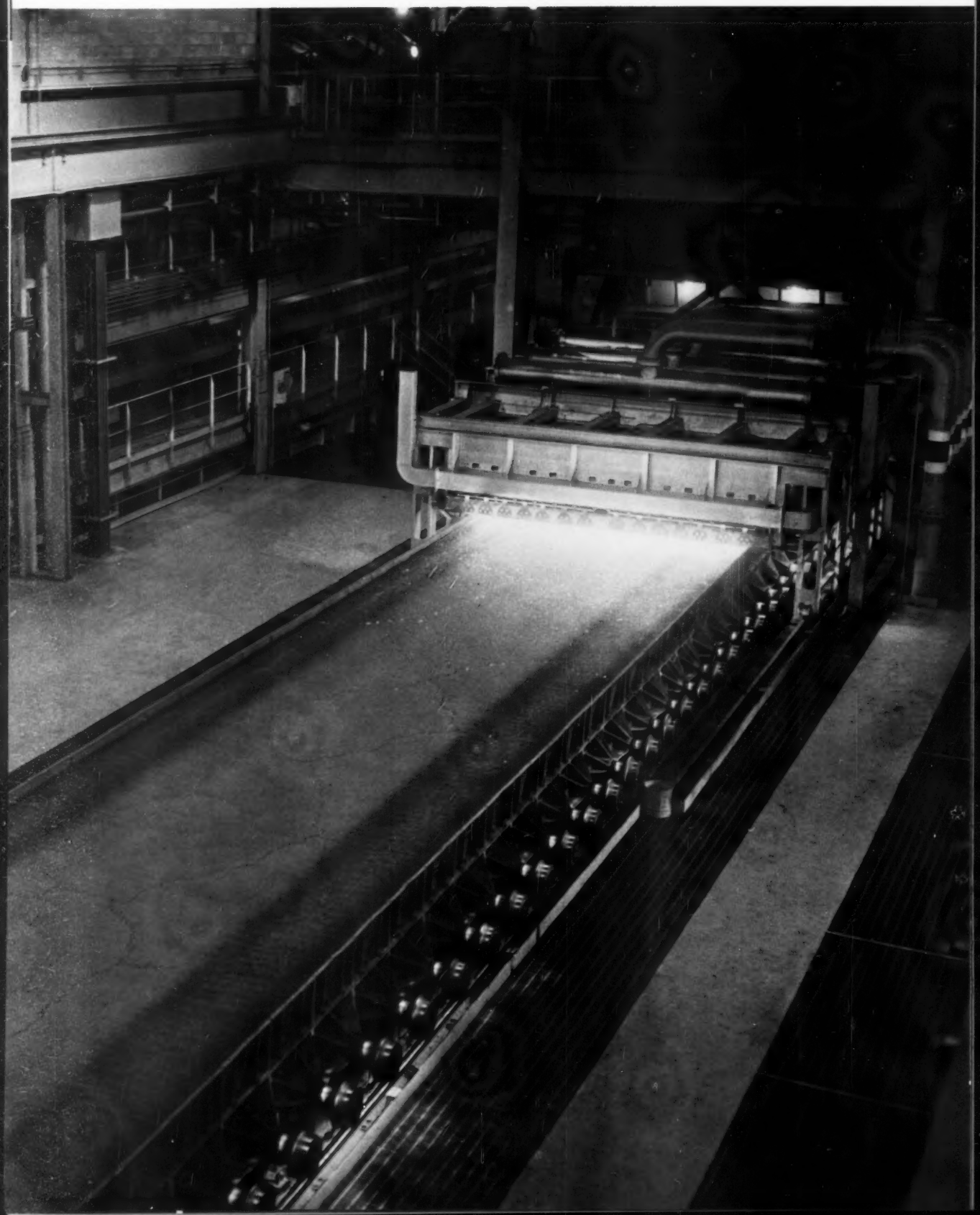
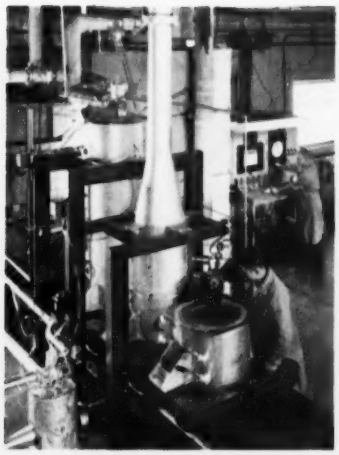
K118

Agglomerates, Researches, Docks,



Concentrates, Handles, Builds



DOCKS: Large barge fleets dock at this steel company riverside facility to deliver raw materials or pick up outgoing shipments. Dravo pioneered cellular, sheet pile dock construction and has built them of all sizes for all types of industry. Dravo's 60 years' experience in heavy and marine construction can help you on projects such as docks, harbors, shafts, tunnels, foundations, water intakes. Check coupon below for information.

RESEARCHES: Dravo research explores agglomeration processes and establishes bases for plant design of complete pelletizing, sintering and briquetting facilities. Second Dravo-Lurgi ore pelletizing plant for a major metal producer is underway. Dravo-Lurgi iron ore sinter plants account for 45% of new U.S. capacity added in last 5 years. Mail coupon for facts.

CONCENTRATES: Interior of a Dravo-Lurgi magnetizing-roasting kiln, where low grade, non-magnetic ore is reduced to synthetic magnetite for separation by conventional equipment. Two pilot plants, one 10-ton per hour and one 2-ton per hour, are now in service in U.S. Use coupon for data on ore beneficiation processes.

HANDLES: 15-ton capacity ore bridge handles stocking and reclaiming needs of large steel producer's expanded yard. Dravo ore and coal unloaders and container cranes speed handling at mills, industrial plants, power stations, terminals and ports. For information on this equipment, check and mail the coupon.

BUILDS: One of five turn-key steam plants built for major auto maker. Other construction services include Dravo-Linde AG air and gas separation and Stora-Kaldo oxygen steelmaking plants; power and compressor stations; piping, machinery, pumping and water or waste treatment installations. Check coupon.

AGGLOMERATES: Total hearth area of 2,419 sq. ft. (13.17' x 183.75') makes this Dravo-Lurgi facility the world's largest single-strand sinter plant. Use coupon.

DRAVO

Dravo Corporation, 4780 Grand Avenue, Pittsburgh 25, Pa.

Please send me information on the following products and services

- ☐ Docks, Harbors, Foundations
- ☐ Water & Waste Treatment
- ☐ Ore & Coal Unloaders
- ☐ Sinter Plants & Coolers
- ☐ Pelletizing & Briquetting
- ☐ Oxygen Steelmaking
- ☐ Ore Beneficiation
- ☐ Oxygen Plants
- ☐ Mill Lubrication
- ☐ Turbo Blowers
- ☐ Space Heaters
- ☐ Ore Bridges
- ☐ Towboats & Barges
- ☐ Shafts, Tunnels
- ☐ Water Intakes
- ☐ Steam Plants
- ☐ Fabricated Piping
- ☐ Grating

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

NEW R/M COALMOVER BELT

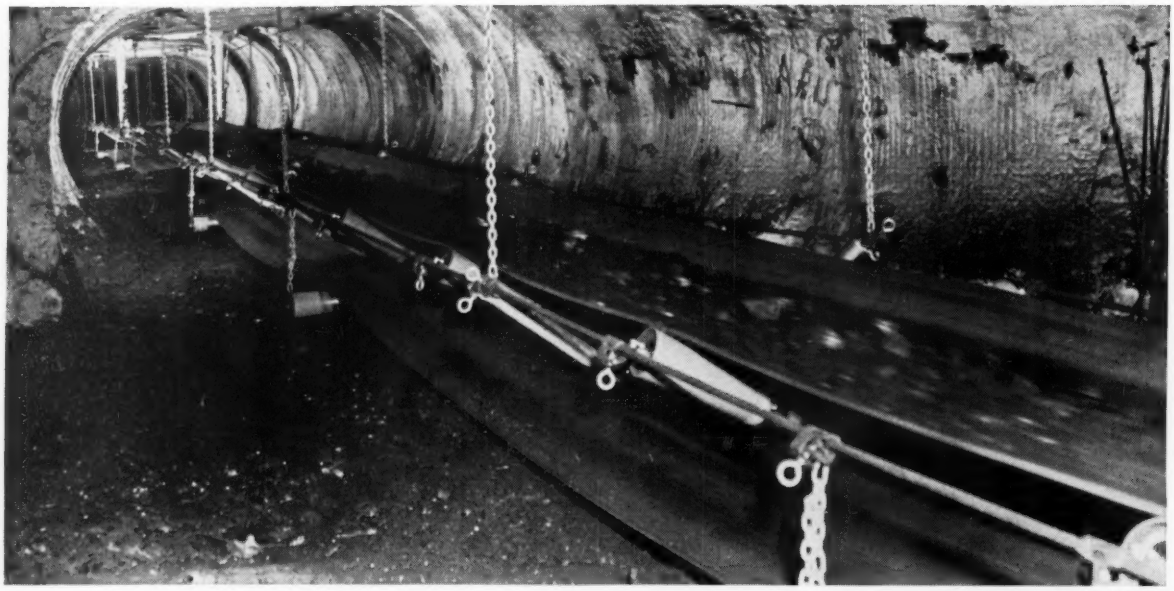


Photo courtesy Goodman Mfg. Co.

. . . Engineered For Mine Conveyors!

Check these belt advantages for *your* underground conveyors. Each is an engineered feature of a completely *new* belt construction for the coal industry—*all* are available *only* with new Coalmover Conveyor Belt.

R/M	How Does Your Belt Rate?
✓ **LIGHT WEIGHT**—easy to handle and re-spool, advancing or retreating	☐
✓ **HOLDS FASTENERS**—holds them *longer*, regardless of type	☐
✓ **LOW STRETCH**—needs only minimum take-up adjustment	☐
✓ **SOLID EDGES**—resists scuffing, fraying or fanning out	☐
✓ **RIP RESISTANT**—maximum protection against ripping, cuts, gouging, abrasion and impact	☐
✓ **EXCEPTIONAL PULLEY GRIP**—won't slip, even at low tension	☐
✓ **EXCEPTIONAL FLEXIBILITY**—lasts longer with reverse bends and snub pulleys	☐
✓ **HAULS EITHER SIDE**—top or bottom	☐
✓ **DEEP TROUGHING**—hauls fuller loads even in low headroom	☐
✓ **HIGH COEFFICIENT OF FRICTION**—prevents load slippage and spillage	☐
✓ **NOT THERMOPLASTIC**—won't stiffen at low temperatures	☐
✓ **FIRE RESISTANT—TOP AND BOTTOM**—Designated "Fire Resistant, U.S.B.M. No. 28-10."	☐

Ask an R/M distributor to show you how R/M's new conveyor belt construction can give you "More Use per Dollar."

"COALMOVER" HAULS MORE...LASTS LONGER...COSTS LESS

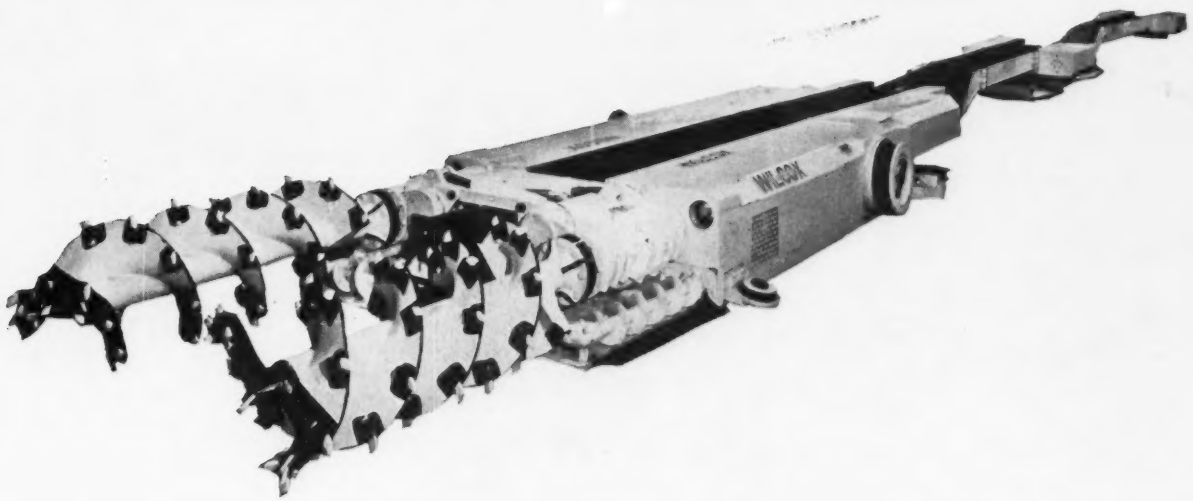
RM117

RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION • PASSAIC, N. J.
ENGINEERED RUBBER PRODUCTS

WILCOX MANUFACTURING COMPANY

. . . Pioneers and Inventors of the Wilcox Continuous Miner, THE MOST successful low seam Miner available, Now offers a greatly improved version of their invention . . .

THE WILCOX MARK 20 MINER



Fast, Streamlined, Rugged and Powerful
THE MARK 20 HAS PROVEN TO BE

. . . LOW in height	. . . HIGH in efficiency
. . . LOW in cost	. . . HIGH in capacity
. . . LOW in maintenance	. . . HIGH in quality

FOR EXTRA TONNAGES . . .
THE WILCOX MARK 20 MINER TEAMED WITH THE WILCOX UNIVERSAL ADVANCE CONVEYOR IS A REAL MONEY MAKER

THE UNIVERSAL Advance Conveyor is a link to true continuous mining

ELIMINATES shift pan-ups	**ASSURES higher tonnages**
ELIMINATES spillages	**ASSURES more production hours**

WRITE OR CALL FOR MINING PLAN

CLIFFORD 26555 in BECKLEY, W. VA. P.O. BOX 217 in RALEIGH, W. VA.

Foremen's Forum

The Personal View: 1911–1961

For the past 50 yr Coal Age has served as a diary of the industry. Browsing in the back issues reveals what men and management considered to be their problems and their achievements, in detail and panorama.

IN THE WORDS of the men who lived the experiences and wrote the record, here is a view of events, technical developments and people during the half-century chronicled by *Coal Age*. Here are verbatim excerpts from issues at 5-yr intervals.

1911 This first issue of *Coal Age* is the realization of a long cherished ambition to give the coal and coke industries, employing 1,000,000 men, a weekly journal devoted exclusively to their interests. . . . This is not a paper for miners only, nor is it intended solely for the men higher up; each individual can skip all that doesn't interest him, and still have plenty to occupy his time and thought. If questions and answers and elementary discussions of basic principles, that are prepared to aid the ambitious man who has lacked educational advantages, seem trivial, and you believe will not add to your enlightenment, then for the love of the lives of the men at the face, encourage, rather than condemn us. The calm of a peaceful day will be broken for many of you because of a lack in the learning of some man lower down.—*From the Foreword in the first issue of Coal Age, Oct. 14, 1911.*

1916 The matter of injured feelings may seem a small and unimportant one, but it is a big factor in determining the future of the young man who aspires to become an efficient foreman. The young foreman is certain to make mistakes, and as a matter of course he must correct such errors. When undergoing discipline of this character, he is liable to feel that he is being imposed upon and to get "sore." This is an unhealthy tendency, and when men get into this frame of mind, they too often brood over imaginary wrongs until their mental state disqualifies them for efficient supervision. Things continue to go wrong, they lose interest in their work and presently find themselves supplanted by others.—*Issue of Feb. 19, 1916.*

Electrified coal hewing

1921 Realizing the growing need of more competency among mine officials, Richard Maize, district mine inspector, Uniontown, Pa., has started a night school for any in his district who are desirous of improving themselves in the knowledge and practice of coal mining. It would be well if all our mine superintendents would follow his example and get their men together in regular meetings for the discussion of different branches of the work. The result would be a great improvement, and help to systematize the work and reduce the number of accidents.—*A letter from a reader, issue of Jan. 27, 1921.*

1926 Satisfactory illumination in an underground room is difficult to obtain unless the roof and ribs are given a coating which reflects light well. Ordinary whitewash serves this purpose satisfactorily, considering its low cost.

Sometime ago when the electrician of Mine No. 20, Island Creek Coal Co., Holden, W. Va., whitewashed the underground shop he accidentally disclosed a useful principle which is not commonly known.

It came about in this way. Not having other material handy he made up some whitewash from unslacked lime and allowed the mixture to cool thoroughly before applying. There was not quite enough to complete the job, so he mixed some more and put it on without waiting for it to cool.

The contrast was noticeable. That part put on while hot had the appearance of glossy white paint and the other the characteristic dusty appearance of whitewash. The glossy portion was a better reflector of light; it appeared not to collect dust so readily and adhered better. —*Operating idea, Jul. 29, 1926.*

1931 Mechanization has developed momentum at a most critical period in the history of coal. At the outset an individual advantage in competition between individual operators, the machine is coming to be recognized as the means by which the coal industry is enabled to compete successfully with rival fuels.

. . . The time to meet the competition of rival fuels with the full strength of coal is at the inception of their development as competitors. Once intrenched, dislodgment is not easy: the gas pipeline once laid, the oil burner once installed will not quickly be abandoned.—*From an editorial, January, 1931.*

1936 Anthracite mines in the Avoca-Duryea-Pittston triangle of Luzerne County and bituminous operations north and east of the Pittsburgh district bore the brunt of the direct damage from the flood waters which inun-

PERCY: "These nuts look almost good enough to eat."

ALBERT: "They sure do. Look at those clean threads, those well-shaped contours."

PERCY: "That's how we know they must be Bethlehem nuts. They make all kinds of nuts, bolts too . . . standard and special . . . and fast delivery."

Steel

For Strength
. . . Economy
. . . Versatility

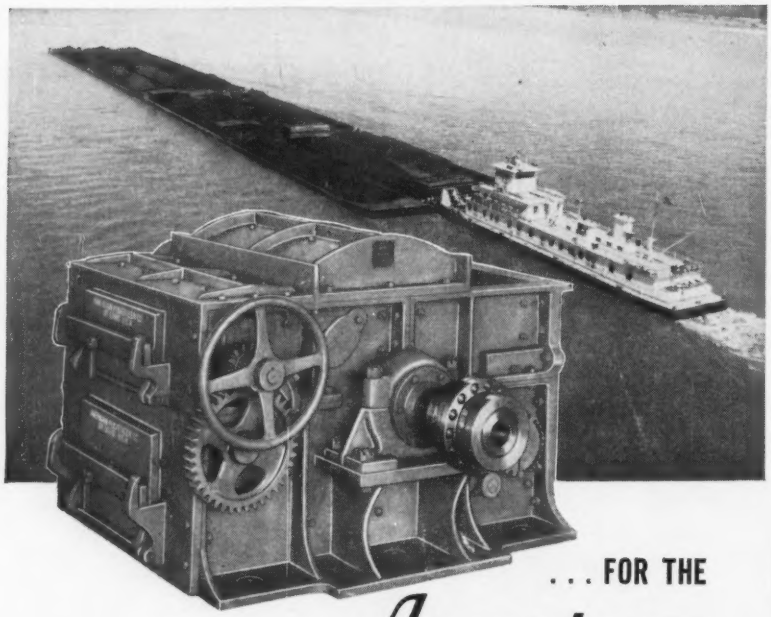
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

12 BARGE LOADS OF COAL IS BUT A SINGLE DAY'S WORK



. . . FOR THE *American*

COAL CRUSHER

. . . and capacity for work is but one of the advantages

The American Coal Crusher will keep on operating at high performance for many years — just like old man river.

At the mine or in the power plant, American Coal Crushers continue to set endurance records — with a total cost of operation of less than 1¢ a ton . . . an average parts replacement costs $.0012 per ton.

Patented manganese steel shredder rings, reversible for double life, manganese steel liners to protect the crushing chamber, and strong ribbed steel frames are among the construction features that give American Crushers the ruggedness that mean savings to every owner.

Figure American Coal Crushers in your cost analysis when you figure ways to better profits.

Write for Bulletin on American AC Coal Crushers

American PULVERIZER COMPANY

ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

6007 1119 MACKLIND AVE. ST. LOUIS 10, MISSOURI

Foremen's Forum

(*Continued from p 248*)

Self-loading conveyors

dated large areas in the East last month.

. . . In many sections hit by the floods, mining operations were sharply curtailed not because of water in the mines but because of power failures, lack of railroad cars due to washouts or inability of men to reach the mines because of road conditions.—*From a Coal Age telegraph survey, published in April, 1936.*

1941 Anyone who has been close to the problems of mechanized mining is fully aware that new mechanized techniques demand organization and supervision of a new kind. Men are required who understand the machine as well as the techniques for producing with it, men who can ask for and receive from their gang the properly timed effort that makes the difference between standard and erratic production, men with a knowledge of ventilation and drainage, mining laws, mechanics, and human psychology.

These men are not born, nor are they graduated from the technical schools. They may be born with the native intelligence, they may learn the facts in school or elsewhere, but it is in their training on the job that they learn to integrate intelligence and knowledge with experience. —*From an article by J. B. Morrow, president, Pittsburgh Coal Co., in the April, 1941, issue of Coal Age.*

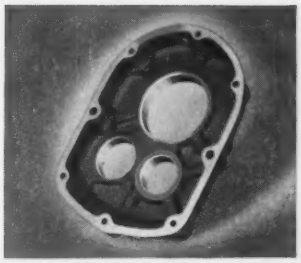
1946 Is atomic power going to push coal out of the picture in the near future? Will it ever? In spite of surmise and opinion represented in various "studies" and reports, including that submitted recently to the United Nations Atomic Energy Commission, the answers to both questions still are no more than "perhaps"—if that. The situation might change, but a careful examination of the material so far available does not warrant assuming that the split atom will be elbowing coal out in, say, five years—or

...the quality-engineered package

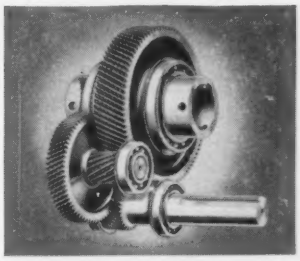
that simplifies speed reduction

DODGE TORQUE-ARM, America's most widely used shaft mounted speed reducer, will save money for *you.* No foundation, no sliding motor base, no flexible coupling, no installation fuss. Developed and perfected by Dodge, this reducer has been so widely accepted in industry that it is now built and stocked in this unmatched range of sizes and models: capacities up to 170 hp; output speeds from 10 to 400 rpm; ratios of 5:1, 15:1, 25:1; speed ratios up to 175 to 1 with correct selection of speed reducer and V-belt drive. Built-in backstop available. Also positive overload release. Vertical models. Flange mounted models. Special application models... Go modern—go Torque-Arm! See your Dodge Distributor, or write us.

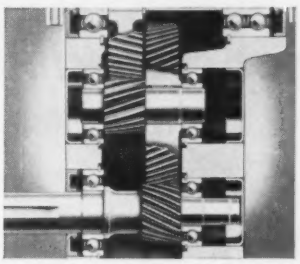
Dodge Manufacturing Corporation, 3000 Union St., Mishawaka, Ind.



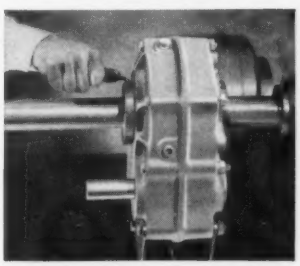
Rugged, semisteel housing holds bearing seats in line for entire life of unit. Laughs at loads. Corrosion resistant.



AGMA rated helical gears. Soft cores withstand shock; hardened surfaces defy wear. Teeth are crown shaved.



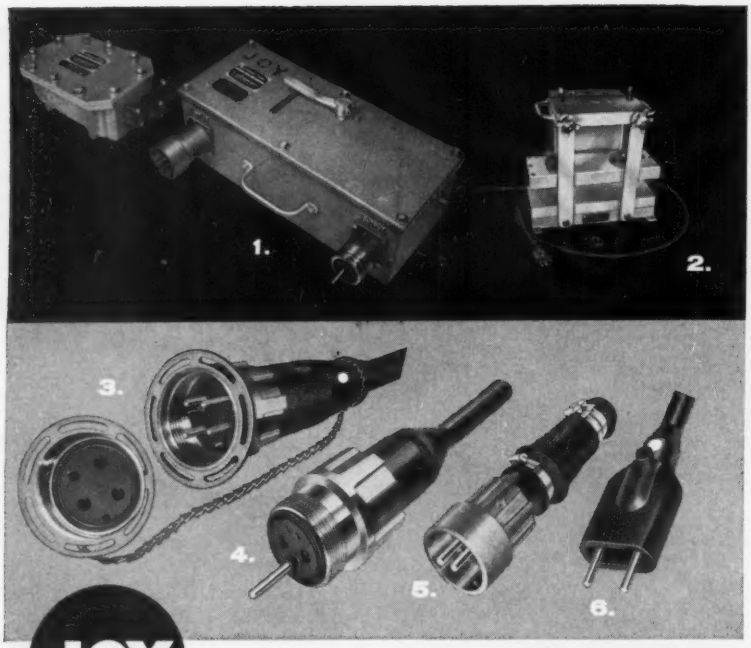
Gears are located *between* bearings and carry their loads without strain. Longer life, higher efficiency.



Unit slides completely onto shaft and locks on *both* sides of housing. This baby stays *put*—runs truer longer.

The Products with the Pluses... **DODGE** ***of Mishawaka, Ind.***

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Look under "Dodge Transmissioneer" in the *white* pages of your phone book. Factory trained by Dodge, he can give you valuable assistance.



JOY ELECTRICAL EQUIPMENT for coal mining

Lectronic Sentry

1. Protects against ground faults, short circuits on D.C. operated off-track mining machines and trailing cables. Continuous monitoring signal between transmitting and receiving elements interrupts when trouble occurs. Circuit breaker instantaneously cuts power to machine and trailing cable. *Requires no grounding conductor*, permits use of lower cost 2-conductor cable.

CABLE VULCANIZER

2. A.C. or D.C. bench model for fast, safe, economical cable repairs and splices. Accommodates molds for patching, splicing, special Y splices, T tap-offs, etc. Vulcanized area is as watertight, flexible and permanent as the original. Portable model also available.

CONNECTORS

3. Hi-Voltage Type — Fabricated with varnished cambric stress cones, then molded in corona-proof body of resilient Hypalon rubber. Body permanently vulcanized to cable. Protective caps can be padlocked.

4. Straight Pin Bigun Style — Threaded metal couplings for positive engagement and disengagement. Double waterseal insures perfect operation under water or in dust choked areas. Molded to 36″ leads or specified lengths.

5. Quik-Loc Style — Similar to Straight Pin Biguns, except for square cut grooves and lead pins instead of machine threads. Engage and disengage in ¾ turn. Attach quickly and easily to cable or can be ordered molded to cable.

6. Oval Style — For general, all-round electrical connections. Lies flat, lessens obstruction. Reinforced at cable-connector junction with taper-neck vulcanization.

Write for detailed Bulletin B73 & B74.

JOY

CD 761.2

ELECTRICAL PRODUCTS DIVISION

1205 Macklind Ave., St. Louis, Mo.

Exec. Offices, Henry W. Oliver Bldg. Pgh., Pa.

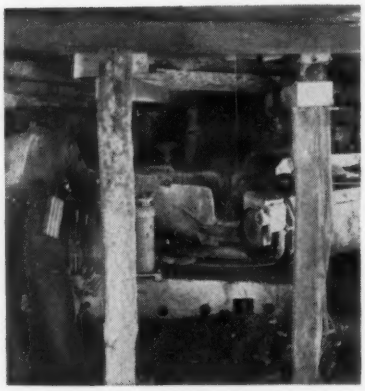
Foremen's Forum

(*Continued from p 250*)

Return from World War II

ten—or twenty—in spite of suggestions that it might be used for generation of electricity, locomotive power, ship propulsion, aircraft operation, heating, etc.

. . . For quite a distance into the future, therefore, coal can reasonably expect that not atomic power but its old foes—oil and natural gas—will continue to be the real troublemakers.—*From an editorial, October, 1946.*



Continuous mining advent

1951 A demonstration-size pipeline system for long-distance transportation of coal will be constructed by Pittsburgh Consolidation Coal Co. this spring as soon as weather permits, the company announced Feb. 8.

The new pilot system, to be built at the Georgetown stripping operation of the Hanna Coal Co. Div., near Cadiz, Ohio, will consist of a 12-in pipeline about 17,000 ft long, together with special coal-crushing and slurry-preparation equipment and special pumps which the company has designed for the purpose. The system, expected to cost about $550,000, will be operated continuously and

FOR FAST, FLEXIBLE ROOF BOLTING

- BOLT UP A WHOLE FACE WITHOUT MOVING OR SHIFTING SAFETY JACKS!
- ANGLE-BOLT ANYWHERE AND USE EITHER ARC OR STRAIGHT LINE PATTERNS!
- CLIMB THE STEEPEST GRADES IN MUD OR RUTTED BOTTOM!
- USE MORE THRUST WITH LONGER FEED FOR FAST LOW-BIT-COST BOLTING!
- FORGET HIGH MAINTENANCE WITH THE RUGGED, SIMPLE FLETCHER DM ROOF DRILL

TAKE A LOOK at the NEW FLETCHER MODEL DM ROOF CONTROL DRILL

BUILT on a four-wheel chassis — with duals on the front — the new Fletcher DM Roof Drill has tractive power to spare. Power steer and individual motors on each wheel, shuttle-car wheel gauge and dual speed "creep-gear" drive let this drill move smoothly around the section regardless of bottom conditions.

The new swinging, sliding boom with 9 feet of in-out range cuts bolt installation time to the bone. A special tray on the boom carrying bolts and drill steels lets your operator complete the bolting of a full place without returning to his tram controls.

Add to this the new "hoseless" M-style mast that gives you up to 40% more feed and greater usable thrust; the new power-geared internal collection drill head; the husky rough service frame *and you can see why* the Fletcher Model DM ROOF DRILL is the newest, fastest, most dependable drill on the market today.

Inquire about it or see it in action in a a nearby mine. You'll want DM's in your mine if you do.

Fletcher
ROOF CONTROL DRILLS

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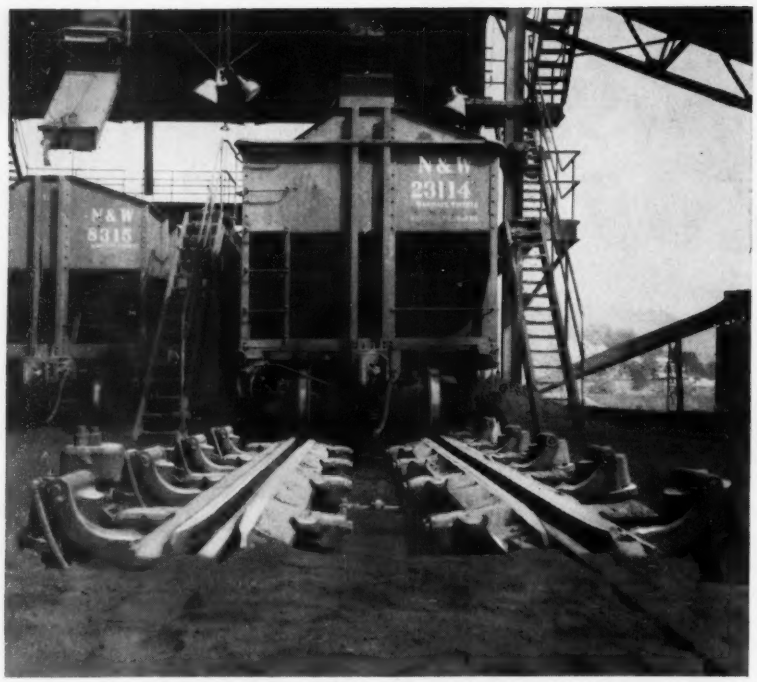


Clinchfield loads 20,000 tons of coal a day safely with Union Switch & Signal Car Retarder System

500 coal cars a day roll through Clinchfield Coal Company's preparation plant at Carbo, Va. They are loaded and classified with a Union Switch & Signal Car Retarder System. The system is fast, accurate and economical. It lets three men do the work of sixteen men. Two yard men and a control tower operator load clean coal at the rate of 20,000 tons on a three-shift schedule—*safely*.

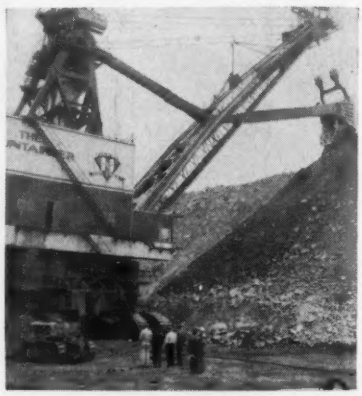
Here, the empty cars drift down a slight grade to a retarder where they are coupled in small groups. Then the cars drift to one of the five coal loaders. After a car is loaded, it is uncoupled and then drifts to the automatic retarder which releases the car for the storage yard at a pre-set speed depending on where the control tower operator wants to place the car in the yard.

If you would like to have complete information about Union Switch & Signal's Car Retarder Systems, contact your nearest Union Switch & Signal office. Or, ask the people who have already installed this equipment.

"Pioneers in Push-Button Science"

UNION SWITCH & SIGNAL
DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY
SWISSVALE, PENNSYLVANIA
NEW YORK .... PITTSBURGH .... CHICAGO .... SAN FRANCISCO

will handle several thousand tons of coal daily.—*From Coal Age News Roundup, March, 1951.*



The big shovels

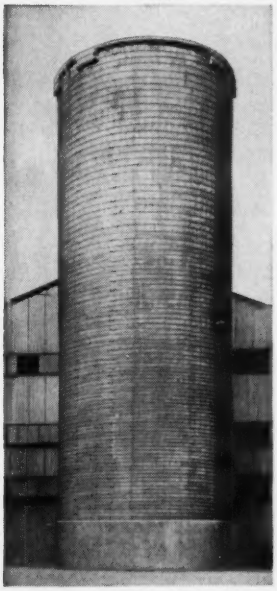
1956 Principle into practice frequently is a frustrating operation, especially in mine ventilation. Consequently, your commentator, who has enjoyed his share of the frustration involved in trying to plan efficient ventilation layouts, and then keep them efficient, is pleased to pay tribute to the experts in the Ventilation Section of the U. S. Bureau of Mines at Pittsburgh. Their latest brainchild is an electrical network analog computer, which can figure just how a proposed change in ventilation methods work out in practice. The possible savings are really impressive. Cost of the machine is $18,000 and in one instance alone it prevented the spending of $30,000 on a plan that would not have worked out in practice.—*From The Coal Commentator, Coal Age, November, 1956.*

1961 Continuing its research in extracting coal by the hydraulic-mining method, the Bureau of Mines has joined forces with the Northern Pacific Railway Co., on a project in the State of Washington.

Because much of Washington's coal lies in steeply-pitching beds and cannot be removed by modern mining machinery, the purpose of the joint venture is to determine whether the coal can be mined with powerful water jets. . . . The Washington experiment should more closely establish the conditions necessary for successful hydraulic operations in different coal seams under varying geologic conditions.

. . . In a similar hydraulic project in Pennsylvania's anthracite region, also characterized by steeply pitching coal, the Bureau will conduct tests at elevated pressure and volume to extract this harder coal.—*From News Roundup, Coal Age, September, 1961.*

It's what's INSIDE that counts!



1

2

3

Most storage bins look good on the outside, BUT...

1. Have they been built to meet the required method of loading?
2. Is the storage area and inside wall built to favor the characteristics of the material to be stored?
3. Will the flow of the material meet the required volume and rate of flow at the point of discharge?

We at Neff and Fry make it a point to see that all three requirements are in balance.

NEFF & FRY COMPANY
310 Elm St., Camden, Ohio

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Coal and Coke Analyses

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Completely Equipped Sampling Truck

Clay - Limestone - Sand

Water Analyses - Stream Pollution Surveys

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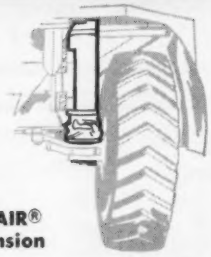
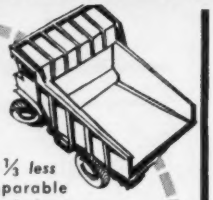


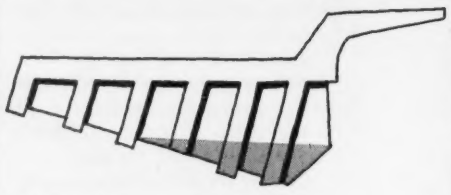
HYDRAIR® suspension

Haulpak rides on air, *not* steel. No springs, no front-axle or related maintenance. Less deadweight. High, 19 to 28-in. ground clearance, short turns. Four simple Hydrair units cushion load and road shocks, keep load riding level.



short turn-circle

Haulpak turns in ⅓ *less* space than comparable haulers, and *much shorter* than many smaller rigs. You have short wheelbase . . . and sharp-angle turn, because there's no spring or axle obstruction at front wheels.



"bonus-tonnage" V-body

Look at the extra load capacity you get within short wheelbase. Deep V-body carries up to 8 tons of material *below* normal floor-line. Center of gravity is *low*. Exhaust-heated body prevents material from sticking or freezing-in.

Is HAULPAK® different?

You bet it is!

Judge for yourself . . . compare some of these basic Haulpak "differences" against trucks you've been using:

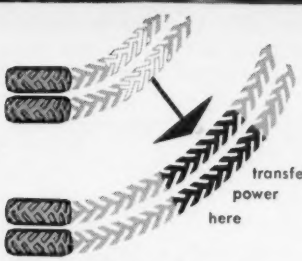
Haulpak, for instance, is so *maneuverable, it U-turns in ⅓ less space than comparable-capacity haulers!* In fact, one owner* says: "Haulpak's short turn-around and high speeds gain us several extra truck-loads a day."

A difference in *speed?* Average top speed of the 5 Haulpak models is *32% faster than the average top speed of all other comparable-size trucks.*

A difference in *safety?* Total brake surface ranges from 3,276 sq in. on the 22-ton Haulpak to 10,186 sq in. on the 65-ton Haulpak. Compare *that* with any other hauler on the market. As another owner* puts it: "From the standpoint of safety, our Haulpaks have it all over the other trucks!"

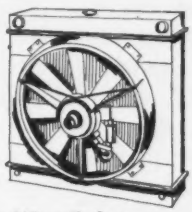
A difference in *maintenance?* There's not a single spring to maintain on Haulpak. And *no* front axle! All parts are easy to get at; many are interchangeable. And you almost *never* have to grease Haulpak. Reports an owner*: "Haulpak has cut our truck maintenance about in half."

For lowest net cost per hauled ton, check the extra tons per hour, lower operating and maintenance costs *you'll* get with LW Haulpak. 5 sizes, 22 to 65 tons, up to 600 hp. More details, or a demonstration, are yours for the asking.



power-transfer differential

Now, for the first time on a truck, you get the LW power-transfer differential. In soft, muddy going, it automatically slows slipping wheels, transfers up to *4 times* the tractive effort to wheels on firmest footing.



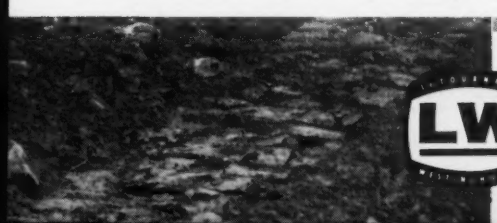
"Power-Miser" fan

On the 27 to 65-ton Haulpaks, an aluminum-alloy radiator fan cools engine with *less* than half the hp-drain of conventional fans. Thermostat automatically shuts fan off when not needed, saves its horsepower for extra work-power.

interchangeable components

You operate Haulpak fleets on a *minimum* parts inventory because: All tires can be rotated to any position. Right and left wheels are readily interchanged, as well as right and left Hydrair units.

HP-2373-G-2



LW

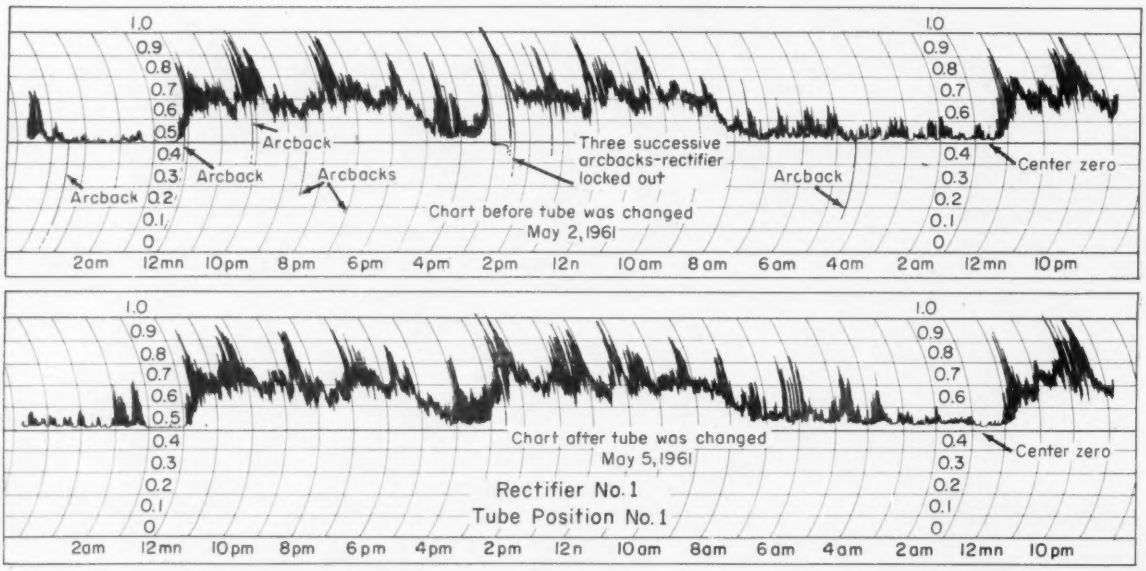
LE TOURNEAU-WESTINGHOUSE COMPANY

PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Operating Ideas


Arcback
Arcback
Arcback
Arcbacks
Three successive arcbacks-rectifier locked out
Arcback
Center zero
Chart before tube was changed May 2, 1961
Chart after tube was changed May 5, 1961
Center zero
Rectifier No. 1
Tube Position No. 1
2am 12mn 10pm 8pm 6pm 4pm 2pm 12n 10am 8am 6am 4am 2am 12mn 10pm

Detecting Faulty Ignitrons

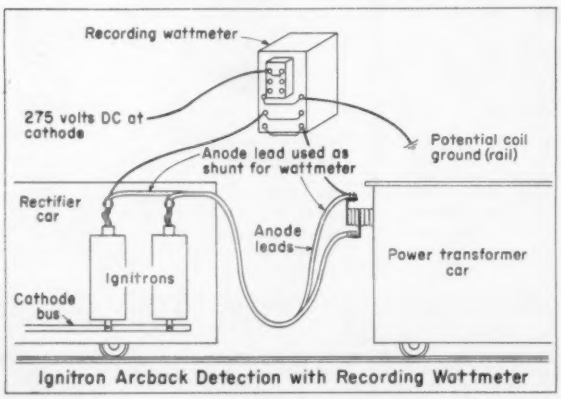
MINING-TYPE Ignitron rectifiers are used extensively in the coal industry for converting AC to DC. In many instances they are located underground near the face and, being fully automatic, are unattended. While these rectifiers are comparatively free of maintenance, there are certain malfunctions that do occur at times, and in some instances it is difficult to pinpoint the faulty component. This is especially true when the trouble is caused by a tube which is "arcing back."

The standard mining-type rectifier has six tubes. Normal control provides for opening of the AC recloser when an arc back occurs on any one of these tubes, and automatic reclosure after a predetermined period. If three arc backs occur successively within a period of three minutes, the recloser is locked out after the third opening. It is then necessary for an electrician to visit the station and reset the lockout device in order to put the station in operation again.

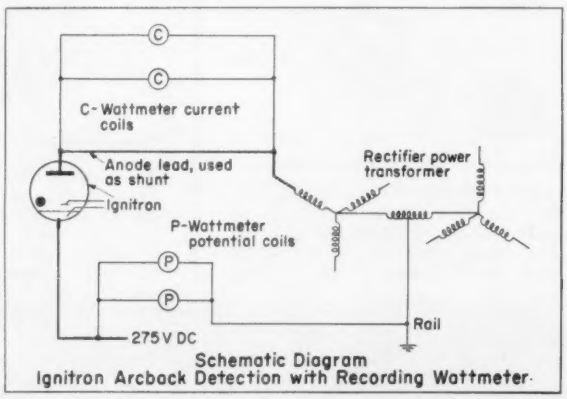
Targets on the AC overload relays indicate that an overload has occurred. However, it is impossible, if the trouble is caused by an arc back, to immediately identify the faulty tube. Various methods for detection are described in instruction books, but most of these require that a person be present to make certain tests immediately following the fault and before the recloser resets.

The engineers of the operating department at Tralee mine of Semet-Solvay Div., Allied Chemical Corp., devised a simple scheme that will definitely indicate an arc back on a tube, the time that it occurred, the relative load on the tube at that instant, and the frequency of the faults.

The accompanying charts illustrate the scheme. They were taken with a recording utility wattmeter having its current coils connected across the anode lead of the suspected faulty tube and the potential coils excited by 275 DC. The anode lead acts as a shunt, and with the meter set for zero in the center, the registration is forward when the tube is conducting normally. An arc back causes an instantaneous reversal of current in the circuit and the registration is in the opposite direction as noted



Ignitron Arcback Detection with Recording Wattmeter



Schematic Diagram
Ignitron Arcback Detection with Recording Wattmeter.

GILCHRIST

When you buy Timken® bearings you are investing in a better bearing value for today and in the future

TODAY'S automobiles, trucks, farm tractors and machines of all types are much more powerful and dependable, and they are heavier. Yet, the Timken® tapered roller bearings used in modern equipment are smaller and more economical than those used 10 or 25 years ago. That's possible because the Timken Company has found ways to pack more capacity into less space by improving bearing steels, design proportions, developing new ways to achieve precision geometry . . . and by investing in bearing life research.

The driving force behind these developments is the Timken Company philosophy of *Service.* Not just institutional service to industry, but the kind of individual, on-the-spot bearing service that Timken Company sales engineers are qualified to give. They are able and eager to give on-the-spot professional assistance to help you build serviceable, reliable, salable machines.

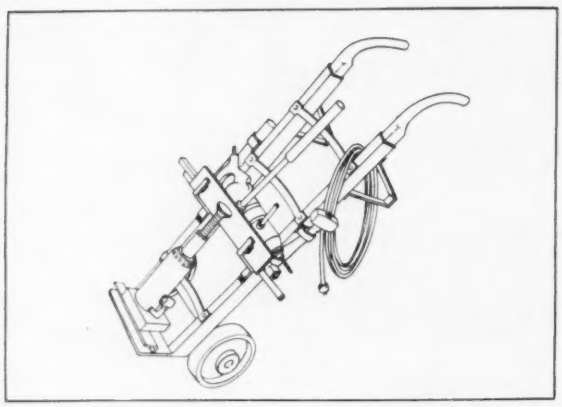
This dynamic partnership with industry has enabled the Timken Company to become the world's largest manufacturer of tapered roller bearings with the enviable reputation of product excellence, pioneering of new applications and bearing industry leadership. It explains in part why Timken bearings are preferred by so many engineers.

An important share of every Timken bearing sales dollar is plowed back into improving research, testing and production facilities. This impatience with just "good enough" is why practically every major tapered roller bearing development has come from The Timken Roller Bearing Company. Invest more of your bearing dollars with the leader—it will repay you in improved products and money-savings—now and in the future.

The Timken Roller Bearing Company • Canton 6, Ohio

on the upper chart. Note particularly that arc backs occurred at light loads as well as during periods of heavy loads. The lower chart was taken on the same tube position after the faulty tube was replaced with a new one.

Usually it is necessary to leave the meter in place about one shift. If no reversals are noted, then the meter leads are changed to another suspicious tube. Careful calibration of the lead length or the use of a standard shunt would permit accurate determination of the effective load in the circuit. In this case we were primarily interested in determining current direction, and made no effort to calibrate the leads. The accompanying sketches show the simple connections for the meter.



Modified Truck Carries Heavy Tools

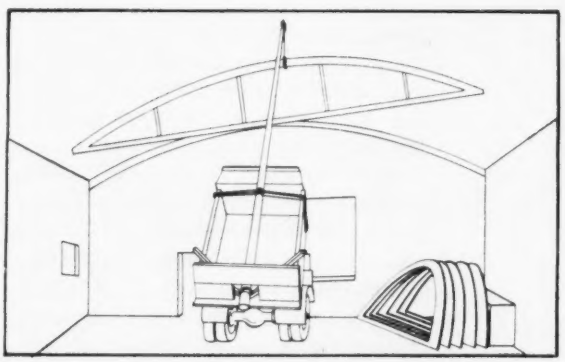
FASTER REPAIRS to truck tires are possible with the aid of a modified hand truck according to *Fleet Owner*. Equipped with special brackets welded to it to carry heavy jacks and air wrenches, the truck enables shopmen to wheel everything they need right to the job.

Air-hose coils around one handle, the shelf carries an impact wrench, sockets, hydraulic jack handles and other tools. Brackets welded to the side of the truck hold hammer and lug wrench extensions. Make it by welding angle-iron shelves and strap-iron brackets to the metal frame of a two-wheel hand truck.

Dump Truck Becomes Crane

WHEN a full-sized derrick would be too expensive to hire or take too long to reach a job, a dump truck can be rigged up to do the job. The following description, published in *Fleet Owner*, a McGraw-Hill publication, explains how one trucking company made a dump-truck crane.

A utility pole was chained solidly in place with the butt in the dump hatch. The pole was lashed to the front of the dump body to steady the end that extends beyond the front of the truck. A short length of chain secures a hook to the end of the pole. Raising or lowering the dump body raises or lowers the boom. Moving the truck positions the load.



Simpler Roof Hanger For Belt

A NEW, simple and efficient hanger for suspending rope-frame belt conveyors from the roof was developed by C. F. Pregenzer, ventilation foreman, International Minerals & Chemical Corp., Carlsbad, New Mexico.

Described in *The Internationalite*, the new hanger is made from angle iron which has one regular hole for securing it to the roof and a keyhole through which chain supports for the rope sideframe are slipped. This new support not only is simpler than the old type but is less expensive.

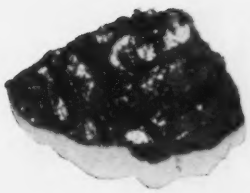
Latex Film Seals Air Leaks

AN EFFECTIVE, easily-applied sealant for stoppings has been developed for the Warwickshire Area of the West Midlands Divisional Coal Board, according to a recent issue of *Iron & Coal Trades Review*.

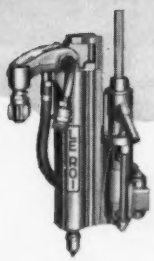
After 3 yr of research, the sealing fluid, a synthetic-rubber spray of the chloroprene group was developed. The sealant, which arrives ready for use in drums, can be applied by unskilled labor with a splatter spray gun similar to the type used for applying undercoating to a car. The film has air retaining properties roughly equal to those of a natural-rubber inner tube for a car.

Although the film takes about a week to harden completely, sealing properties are shown immediately. Developed primarily to provide air-tight stoppings and thus seal off areas where there is the danger of spontaneous combustion, the sealant can be applied to control leakage around doors or airlocks.

MINING COAL IS YOUR BUSINESS...



ours is to make it easier and safer at lowest cost!

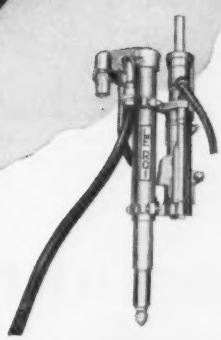


S-20B "DUSTLESS" STOPER
with built-in dust-collection

Only stoper made for 26-in. coal. Drills wherever a man can crawl. By-passes dust through chuck — not the machine. Snap-ring chuck changing, detachable guideways, controls at top of feed cylinder. With 28-, 46-, and 64-in. feeds, 1830 blows per minute.

H10AL AIR LEG DRILL
a tool of many uses

Light, compact unit that can be used as stoper, drifter, or hand-drill. One-man operation. Has common air hose for air leg and drill, 11 feed pressure settings for air leg and 4-way throttle valve, automatic controlled wet backhead, 72-in. feed.



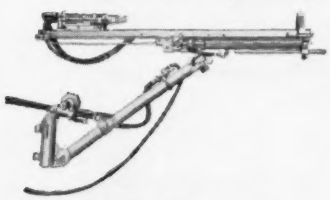
S-12VT STOPER
drills dry and clean

High-speed, hard-hitting stoper with telescopic feed for full-pressure drilling. Swooshes cuttings through 5-hole bit into hollow drill steel and out through the chuck — not the stoper — then into the dust box. Eliminates stuck steel. With 34- and 52-in. feeds.

DUST COLLECTOR TANKS
only ones with B of M Approval

DK-288 — a low-volume, high-pressure tank for Le Roi Vac-Nu-Matic® stopers and drills. Vacuums dust from hole to box, by-passing tool and operator.

LX-1 — a 45-lb. portable dust collector for Le Roi Vac-Nu-Matic® stopers and drills. Self-dumping collector can be emptied by remote control at the drill — keeps operator drilling hole.

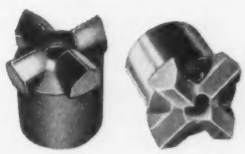


MDR JUMBO ARM
for single or gang mounting

Heavy-duty, high-speed drills that can be mounted on jumbos, rigs, tractors, and trucks — with air motor power. Air motor and drifter can be remotely controlled. Steel change to 6 ft., feed travel to 8 ft. Hydraulic jumbo arms also available.

LO-380 LINE OILER
protects tools automatically

You'll never burn out an air tool with the LO-380 on the job. When oiler runs dry, it automatically shuts off the air. Meters oil flow at 10 to 150 psi to all parts — extends tool life and cuts repairs. Works in any position, and can be filled under pressure.



CRD ONE-USE BITS
good and inexpensive

Hard-biting, long-lasting bits for drilling in any kind of rock. Easy on and easy off. When dull, you can afford to throw them away. Cost less than sharpening and handling conventional bits. By far the sharpest buy at less than "two-bits" apiece.

Le Roi offers you the right choice of air tools and accessories for roof-bolting, drifting, blasthole and exploratory drilling — in any kind of rock. And you get the best, because Le Roi has pioneered the development of air equipment to make drilling for coal easier, faster, safer, and more productive. Remember, to keep men and tools drilling — standardize on Le Roi.

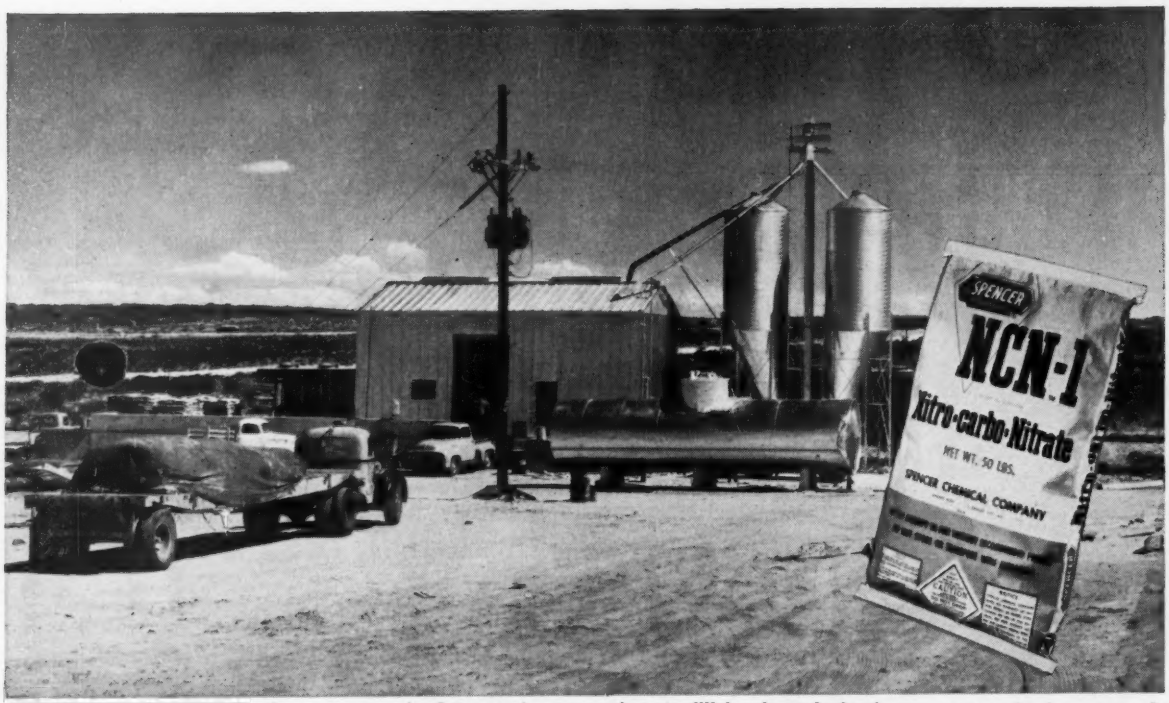
AF-106

LE ROI AIR EQUIPMENT

LE ROI DIVISION
WESTINGHOUSE AIR BRAKE CO.
SIDNEY, OHIO

PORTABLE AND TRACTAIR® COMPRESSORS • STATIONARY COMPRESSORS • AIR TOOLS

Distributed in the Coal Fields by: Acme Machinery Company, Huntington, West Virginia, and Equipment Service Company, Inc., Birmingham 4, Alabama.



First local supply center for Spencer pre-mixed ammonium nitrate blasting agent (NCN-1) is located at Carlsbad, New Mexico. Similar plants are proposed for other sections to fill local needs for low cost pre-mixed compounds of guaranteed uniform quality. Spencer NCN-1 Nitro-carbo-nitrate will be available in handy 50-pound bags.

Spencer announces NCN-1*

. . . another new service to lower blasting costs

More blasting efficiency for every dollar you spend! That's the promise of Spencer's far-ranging research program. This continuing program of investigation explores every new and better method of making blasting more efficient, safer, and less expensive.

Newest development in Spencer's program of maximum service to mining and construction users of blasting materials is an NCN-1 (Nitro-carbo-nitrate: pre-mixed ammonium nitrate blasting agent) plant in Carlsbad, New Mexico.

Designed to deliver NCN-1 by truck in handy 50-pound bags to the site where they are to be used, this new plant is the first of a network of producing depots that will provide local sources of supply to users in every part of the country.

Pre-mixing of the ammonium nitrate blasting agents provides a cleaner, easier to handle compound with more uniform blast output. Initially, the Carlsbad plant output has been established to meet current daily demands, but capacity expansion is planned to meet anticipated future increases in local usage.

And, of course, Spencer's NCN-1 is substantially less expensive than dynamite. But that's not all. Spencer's NCN-1 will provide 10% to 20% more blast energy than field compounded ammonium nitrate-fuel oil mixtures. That's accomplished through easier detonation resulting from the optimum density of the Spencer mixture and the special prill structure of Spencer's N-IV* ammonium nitrate which enables it to absorb fuel oil more evenly.

Spencer research has paid other use dividends to users of blasting materials. SPENITE*, Spencer's remarkably efficient boosting material, was made possible when Spencer investigators proved that in boosting ammonium nitrate-fuel oil mixtures, the heat generated was more important than the velocity of the detonator. As a result, SPENITE boosters provide 50% more explosive heat than any other commercial booster.

And Spencer research is responsible for the efficient Powder Monkey* pneumatic loading machine. 40 of these units currently in the field have proved that a two-man team using the Powder Monkey can outperform any other method of filling horizontal holes with blasting charges. It's another way Spencer makes blasting more efficient and at the same time, slashes costs to the bone.

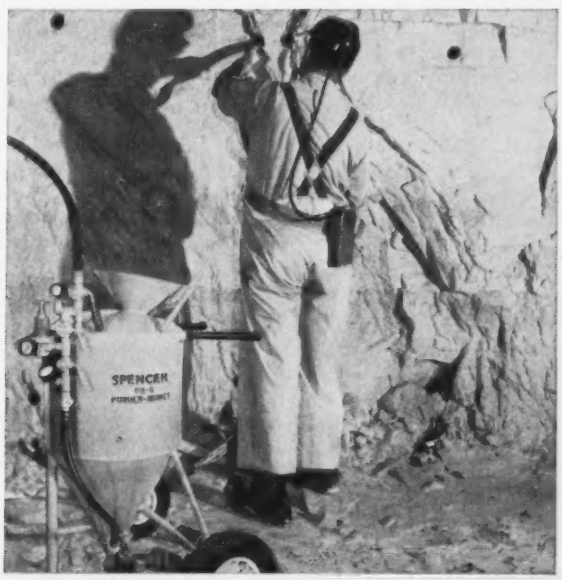
For information on any of the advanced Spencer products for blasting, simply write to Spencer Chemical Company, Dwight Building, Kansas City, Missouri.

*Trademarks of Spencer Chemical Company

Only Spencer research uses advanced underwater testing methods adopted from military research to develop safer, more efficient blasting methods. Tests have proved ammonium nitrate and fuel oil delivers up to seven times more useful energy per dollar than gelatin dynamites.

A low-cost initiator is provided by Spencer SPENITE. Made specifically to detonate ammonium nitrate mixtures, SPENITE threads easily on detonating cord. Knots hold boosters in place when cord is lowered into hole. Results: big cost reductions in the detonation.

Bulk ammonium nitrate (N-IV), a step forward in reducing material and handling costs, has been accepted by a number of users. Why not investigate the pickup or delivery of money-saving bulk ammonium nitrate from Spencer. Customers report their explosive costs cut in half when they use Spencer N-IV.



Spencer Powder Monkey is the easiest, most economical method ever devised to fill blast holes. One two-man team recently filled and blasted more than 250 holes in one eight-hour shift while using this Spencer Powder Monkey pneumatic loader.

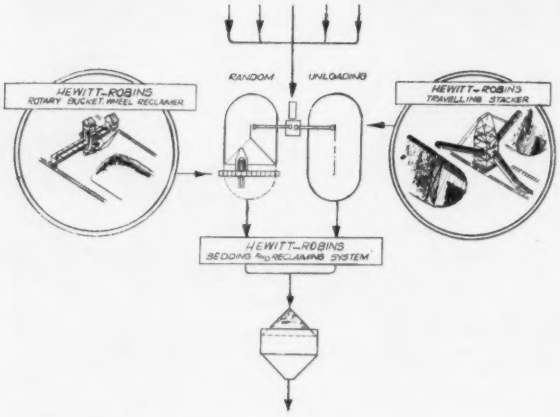
*Trademarks of Spencer Chemical Company.

Look to Spencer research for continual advances in blasting efficiency and economy.

SPENCER®

SPENCER CHEMICAL COMPANY
Dwight Building • Kansas City, Missouri

New Equipment News



Simplified Method for High-Capacity Reclaiming

A simplified method for the continuous reclaiming of stock-piled material at capacities from 200 to 4,000 tph has been achieved by the Rotary Bucket Wheel Reclaimer developed by Hewitt-Robins.

Taking the basic idea of the bucket wheel digger, the company redesigned it for better discharging, mounted it on the truss of a traveling bridge and supported the truss on end trucks. It travels on rails.

In operation the machine rotates as it moves traversely across the face of the material as the reclaimer moves slowly into the bed. The harrow, resembling a huge rake, is mounted in front of the traveling bridge in a fixed position and dragged across the face of the pile. It minimizes cascading and feeds the material to the wheel. Here the material is picked up by buckets which discharge it to a conveyor on the truss section of the traveling bridge. The conveyor, which can be reversible, delivers the material to a reclaiming conveyor located parallel to the bed.

This new system eliminates or minimizes selective mining, provides blending at no extra cost, lowers operating costs, increases production and simplifies processing. For complete information, write the company.

Hewitt-Robins Incorporated, 666 Glenbrook Rd., Stamford, Conn.

Tire Features Shredded-Wire Undertread

Shredded-wire undertread built into all Goodyear's large-sized off-the-road tires is reported to greatly increase tire life and reduce replacement and maintenance expense for heavy-equipment operators.

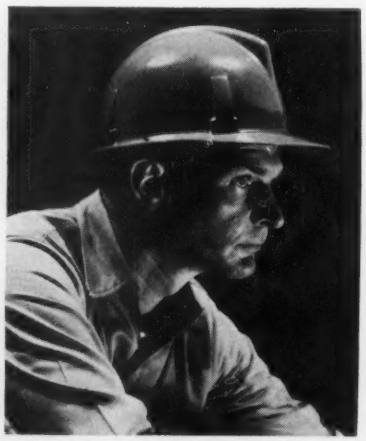
Lying between the fabric body of the tire and the outer tread, the rubber undertread contains millions of tiny pieces of built-in wire, as shown in photo of tire cross-section.

In production, the wire is mixed in the rubber in a process in which tremendous force is exerted to assure an even, lasting dispersion of the wire. This wire-reinforced rubber then is formed into thin sheets which are laminated to form the undertread section of the new tire.

This construction results in exceptional cut resistance by providing a barrier of high-tensile steel, limits growth of any cuts that do occur and gives better adhesion between tread and tire body, reports Goodyear.

The wire is .0058-in in diameter. A 33.5-33-size tire would contain more than 6 million pieces of wire, weighing about 19 lb.

Goodyear Tire & Rubber Co., Akron 16, Ohio.



Safety Hats Contain New Thermoplastic

Introduction of the "Topgard" hat line marks the first time polycarbonate, the most advanced of the new, engineering thermoplastic materials combining the impact strength of metal and the natural resilience of plastic, has been incorpo-

LET'S TALK RELIABILITY...

"Very good machine and very easy to operate. Handles with ease. I really enjoy working with a machine of this type. We haven't had a major breakdown in 2½ months and this machine goes 24 hours a day, seven days a week. That is what I call punishment for any machine. It amazes me the way it holds up."

You get MORE with MARION

... and congratulations to COAL AGE for 50 years of valuable service to the industry.

Advertising talk? No. The comments were made by Nate Rigle, one of the operators on the Marion 7400 Walker pictured. The unit is owned by Sullivan Trail Coal Company and is working at their Wilkes Barre, Pennsylvania property. This electric walker employs a special customer-designed 15 yard dragline bucket on 160 foot of boom. And, how it produces!

The simple fact is that reliability and production go hand in hand. The machine that stays on the job is the machine that produces. That's the big reason why Marion Walkers can be found in the best of mines ... the best of company. Why not contact a Marion mining specialist for information on how Marion Walkers can help you develop your property profitably.

MARION POWER SHOVEL COMPANY · MARION, OHIO

A Division of Universal Marion Corporation

rated into manufacture of a safety hat or cap.

Reported to be virtually indestructible, the new head protection is lightweight and designed with a single-ridge construction to help deflect the force of a falling object. In addition, it will retain flexural strength and rigidity at extremely low and high temperatures—100 to 270 F.

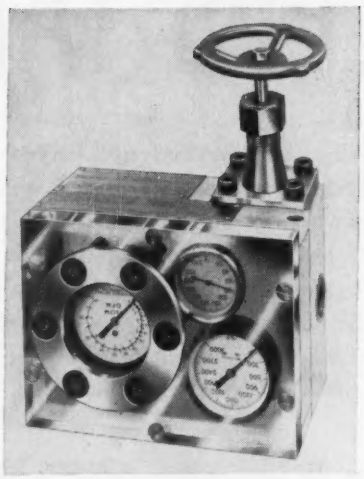
The new line continues MSA's fixed-crown suspension which features a double-cradle design. This critical crown clearance – at least 1¼ in – is tamperproof. The upper cradle is fixed permanently for a built-in safety margin while the lower cradle adjusts to the wearer's own comfort.

Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.

Unit Locates Hydraulic System Troubles

A compact, low-cost, portable instrument that can pinpoint hydraulic system problems in a matter of minutes has been developed for on-the-job use wherever hydraulics (up to 3,000 psi) are employed.

With the "Hydra-Sleuth" installed on



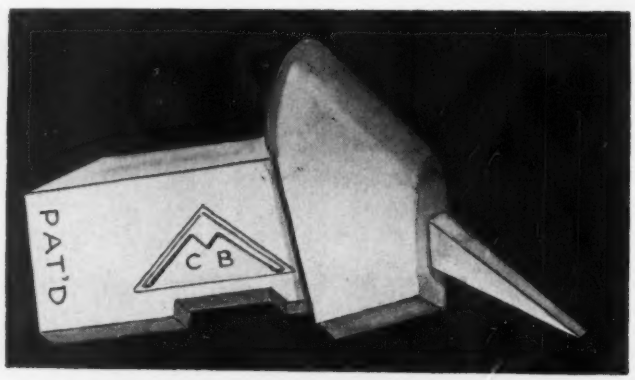
a piece of equipment, hydraulic troubles show up as a drop-off in gpm on the flow gage, as working pressure is developed with the load valve. Trouble is then isolated to the pump valve or cylinder by taking flow, pressure and temperature readings on various sections of the circuit.

Weighing only 20 lb full, the instrument case measures 5x6x8 in. A high-strength aluminum block serves as case and manifold for gage porting and mounting. And a heavy plexiglas cover protects gages from external damage while the steel-load valve stem and hand wheel serves as a convenient carrying handle. A built-in safety-blowout plug protects both the "Hydra-Sleuth" and the system on which it is used from overloads.

Schroeder Bros. Corp., McKees Rocks, Pa.

MARATHON

"Save your Money Bit by Bit"



Let US Solve

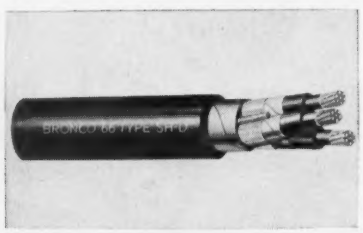
Your Bit Problems

MARATHON

COAL BIT COMPANY, INC.

MONTGOMERY, WEST VIRGINIA

Phone-Hillside 2-2478



Safer Power Cable

The most unusual feature of a new, flexible, portable power cable is its outer protecting jacket which contains 67.32% neoprene. This is believed to be the highest neoprene content in the industry and further increases the safety-construction design of the cable.

"Bronco 66," Type SH-D cable is made with a semiconducting tape over the coated, flexible, stranded conductors, which prevents the formation of corona by distributing electrical stress over the entire circumference of the conductor. Over the tape is an advanced type insulating material—Bronco XL

Butyl—which further raises the margin of safety for this cable. A colored tape and woven-copper-wire shield cover the insulation. The copper-wire shield assures symmetrical electrical stress within the insulation and protects against induced overloads. A binder tape is wrapped around the cable assembly and over this goes the 67.32%-neoprene outer-protecting jacket.

Three conductors in sizes 6 through 4/0 awg with a choice of coarse, medium or fine stranding are offered.

Western Insulated Wire Co., 2425 E. 30th St., Los Angeles 58, Calif.

Conveyor Belt Withstands Crushing Impact

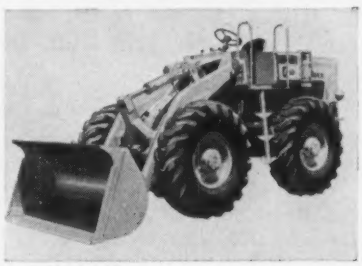
A new conveyor belt, called "Hy-Impact" because of the crushing impact it withstands from rock and abrasive materials, has been especially designed for use on portable and permanent conveyor systems or on any section of a system carrying these materials.

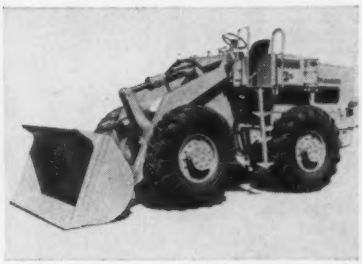
The belt's fabric design — named "Shock-Weve"—is a radical departure from conventional fabric weave. Besides having more bulk, it has greater all-around resistance to puncturing in all directions. Because of this construction, Hy-Impact is more flexible while still maintaining ideal load support and can also be used on 45-deg troughing idlers.

In addition, reinforcing members of the belt have a superior resistance to impact due to greater shock absorption. Although this belt provides a greater service life than conventional belts, thereby reducing installation and operating costs, it is still priced at the same level, according to the manufacturer.

The new type construction can be made in any grade or quality of belting to match standard 28-, 32-, 36- and 42-oz standard belting fabrics and can be supplied in any of the standard synthetic fabrics.

Acme-Hamilton Mfg. Corp., Meade St., Trenton, N. J.





Front-End Loaders

Joining the parade of new Hough machines are two four-wheel-drive, rubber-tired front-end loaders. Bucket capacities of these Series "C" "Payloader" units is 1¾ cu yd for the Model H-60 (left) and 2½ cu yd for the H-70 (right).

Designed for maximum safety and comfort, both units feature simplified Hough bucket and boom mechanisms with from 4 to 10 fewer pivot and grease points. All steering, boom and bucket pivot points have protective seals to keep grease in and dust and dirt out. In addition, a "no-stop" power-shift transmission is included.

The H-30 offers a choice of gasoline or diesel power with engines developing 110 and 107 hp respectively. A 148-hp diesel engine powers the H-70. Many options are offered for both series.

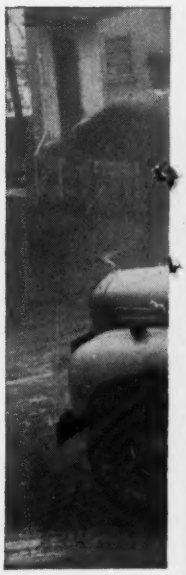
Frank G. Hough Co., 735 Seventh Ave., Libertyville, Ill.

■ Athey's all-new PH630 Coal Hauler steps up production . . . speeds cycles . . . cuts costs. You get a full 85 yard capacity with the PH630. For power, there's Caterpillar's* new 630 four-wheel, 420 H.P. Tractor with travel speeds over 40 m.p.h. and new Power Shift Transmission with 9 speeds through 3 shifts. Ground-hugging roadability allows sharper turns and better maneuverability at higher speeds, meaning more usable power on the job. The PH630 loads quickly, too . . . offers a big target and low loading height. Fast-action dump drops load fast. Pound for pound, Athey's new PH630 out-performs all others. See it . . . compare it . . . at your Athey-Cat dealer's today!
Write for facts . . . Find out how Athey's PH630 Coal Hauler helps move bigger loads . . . faster . . . for top economy.

PH 630 COAL HAULER

Athey PRODUCTS CORPORATION • 5631 WEST 65TH ST. • CHICAGO 38, ILL.
Designers and Manufacturers of Heavy Duty Loading and Hauling Equipment
*Caterpillar and Cat are registered trademarks of Caterpillar Tractor Co.

ALUMINUM DUMP BODIES WEIGH 50% LESS...



Haul Up to 3,500 Lb of Extra Payload for Added Profit

Durable Alcoa Alloys Defy Denting to Save Maintenance Dollars

Dent Resistant

Modern Alcoa Aluminum alloys, advanced design and new fabricating techniques combine to give today's aluminum dump bodies far greater dent and impact resistance than standard steel construction. They withstand years of hard knocks and grueling service. Service records prove aluminum assures longer unit life with less maintenance.

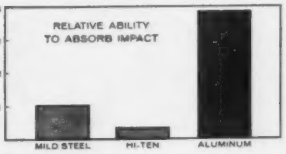
Light Weight

When you trim a pound of dead weight from a rig, you take on an extra pound of payload worth a dollar per year in extra revenue. Producing earnings as much as 16 per cent above average, lightweight dump bodies of Alcoa® Aluminum can pay for themselves in less than a year of operation. From then on, it's *all extra profit* for the operator.

Corrosion Resistant

Aluminum's corrosion resistance helps hold down repair costs to boost earnings even further. Needing no protective coating of paint, aluminum alloys stand up under the corrosive and abrasive attack of many commonly hauled bulk materials. Chemicals, salt, high-sulfur coal, fertilizers, lime and sand can't inflict damage, so aluminum dump bodies stay new-looking far longer than steel, wash clean in half the time—and dump clean every time.

A dump body folder, which tells how many operators have increased profits by switching to aluminum, is yours for the asking. Write to Aluminum Company of America, 1789-K Alcoa Bldg., Pittsburgh 19, Pa.



PROOF: Aluminum Is Tougher
Tougher than steel! Dump bodies built of Alcoa Aluminum alloy can take *three* times as much impact as steel, at *half* the weight

Member ATA FOUNDATION INC American Trucking Industry

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

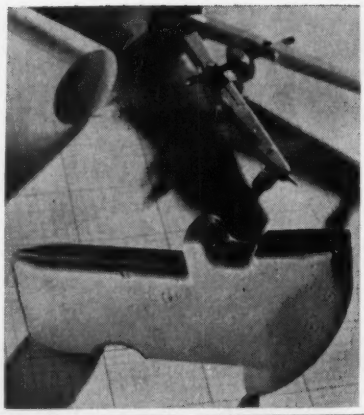
Entertainment at Its Best . . . **ALCOA PREMIERE** with Fred Astaire as Host . . . Tuesday Evenings, **ABC-TV**

Drill and Cutter Bits

Two tungsten-carbide mining bits are credited by their maker with stepping up coal production and lowering both production and maintenance costs in coal mines around the world.

The "RS" (left) is a single-point cutter bit incorporating the bottom notched shank. It is for use in standard cutting chains where set screws have been replaced with quick-change keepers to considerably reduce the time required for changing bits.

Classified as an all-purpose drill bit, the "AP" model (right) has been designed with eccentric cutting tips to speed penetration during blasthole drilling in coal mines without coring. This nontracking bit also drills in soft natural mine rock and bone coal.



Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.

BRAD HARRISON

ATTACHABLE CABLE COUPLERS

PERMISSIBLE and FRESH AIR

(INTERCHANGEABLE)

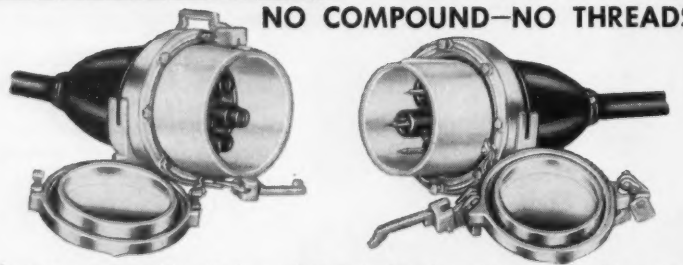
600 VOLT SINGLE CONDUCTOR CABLE TO 750 MCM.

MULTI CONDUCTOR DC TO 400 MCM, AC TO 300 MCM.

NO SKIMPING in construction with generous cross sections of copper. Terminals and terminal set screws designed for unusually firm wire attachment. Extra long life. Operates as **cool** or **cooler** than cable. The **ORIGINAL THREADED BOOT** forms water tight wiring chamber with ease of assembly. Fresh air and gaseous use, **permissible** (Bureau of Mines Approval #2-1222.) Permissible Type D Coupler used with **Standard Type G, and P G Cable** and easily interchanged with Fresh Air Type "C" Coupling. *CAT. #6-59C*

HIGH VOLTAGE MULTI CONDUCTOR CONNECTORS 7500 VOLT

NO COMPOUND—NO THREADS



All parts replaceable, Male and Female housings interchangeable, extra tracking distances, air insulation in wiring chamber **NO COMPOUND.** Plugs and sockets silver plated copper, molded in ozone resistant compound. Water tight, protected against condensation, **NO THREADS.**

Full line of superior quality "PUSH-PULL" connectors listed in Catalog #4-57

BRAD HARRISON CO. *Write for information*

4222 WARREN AVE. • HILLSIDE, ILLINOIS • Phone LINDEN 4-2800

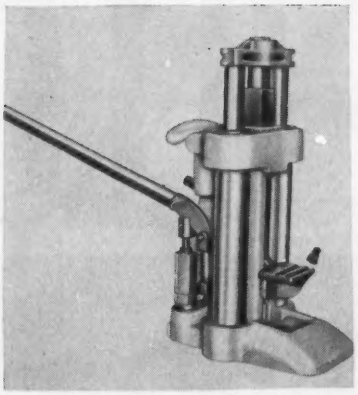
Hardfacing Rod

Electric-arc application of tungsten-carbide hardfacing has been improved by development of a new solid-core "Kenface Arc Rod," particularly recommended for large pieces on which gas application is not practical.

The KT-200 rod is composed of a solid tungsten-carbide core surrounded by a steel sheath with a coating that permits depositing a hard surface as smooth as that applied by a mild steel welding rod. The deposit flows on easily with an extremely low porosity and minimum of heat checking. Either bead or wash pass application is suitable with the KT-200.

Although AC application is recommended, the rod can be applied by either AC or DC reverse polarity current (160-200 amp, 16-20V). Rockwell C hardness of deposits range from 58 to 63 for a single pass and from 60 to 65 for double pass. Coverage of ⅛-in thickness is 25 sq in per lb of rod.

Kennametal Inc., Latrobe, Pa.



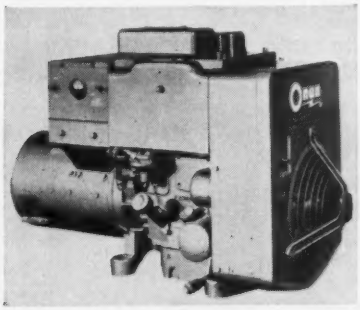
Toe-Lift Hydraulic Jacks Raise 15 Tons

"Hydra-Toe" toe-lift hydraulic jacks, in a choice of self-contained or remote-controlled models, can lift 15 tons.

The units are designed to completely eliminate cylinder scoring. An alloy-steel bar is suspended from the top between the twin-hydraulic cylinders of the units and rides in the aluminum-alloy housing. This arrangement prevents any wear from affecting the hydraulic system—previously the principle source of trouble in toe-lift hydraulic jacks. The suspended bar floats and has machined grooves in the large heat-treated toe.

Model S-159 is self-contained and has both high- and low-speed pumps. Model R-159 is remote-controlled by hand or powered gasoline, electric or air pumps. With sufficient reservoir capacity, any number of jacks can be used to instantly pick up low loads. A jack and gasoline pump, for example, will lift 15 tons 9 in in 12 sec.

Templeton, Kenly & Co., 2525 Gardner Rd., Broadview, Ill.



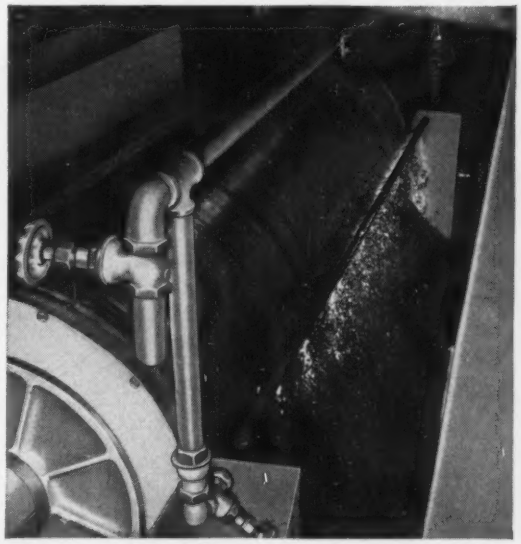
Basic Engine Line Offers Innovations

A new family of 12 basic engines—the "Onan J Line"—provides unusual features such as interchangeable parts, choice of gas, gasoline or diesel fuel and water- or air-cooled models—all fabricated from one basic set of tooling.

With from 3,000 to 15,000-w electrical

"Stearns' WPD'S save us at least $3,780 a year,"

states Dale H. Burkhalter, Buckheart Mine Preparations Mgr. The United Electric Coal Companies, Canton, Illinois.



Here's a Stearns 30 x 72 in. INDOX V permanent magnet drum separator at work in The United Electric Coal's Buckheart Mine processing plant. These INDOX V permanent magnet-equipped units are setting new records for efficiency and low-cost operation in heavy-media recovery applications like this throughout the country.

"Our Stearns WPD's are saving us $2,280 a year in maintenance alone — and that's just one reason why our future modernization plans call for Stearns INDOX® permanent magnet separators across the board." Mr. Burkhalter added.

Other significant savings reported by this satisfied customer include:

Lower Operating Cost — Up to $500 savings per unit annually due to elimination of power for electro coil energization.

No Costly Shutdowns — According to the plant foreman at Buckheart Mine, "Our Stearns units have never caused a shutdown for cleaning or repairs — even when they're overloaded, they still keep running."

Efficient Media Recovery — Buckheart Mine chemist reports, "These Stearns separators have more than lived up to performance claims."

These are just a few of the reasons why *Stearns* INDOX *V wet drum separators outsell all others* in heavy media applications — over 100 successful installations since late 1958.

Broadest Equipment Line

Stearns offers INDOX V wet drum separators in diameters of 30 and 36 inches, with magnet widths from 15 to 72 inches, single, double, or triple-drum construction in either concurrent or counter-rotation styles.

To take advantage of Stearns' unmatched experience in HMS applications, call in one of our engineers today for a job-studied recommendation and price quotation. Literature sent on letterhead request — ask for Bulletin 2013-U.

DIVISION OF INDIANA GENERAL CORPORATION

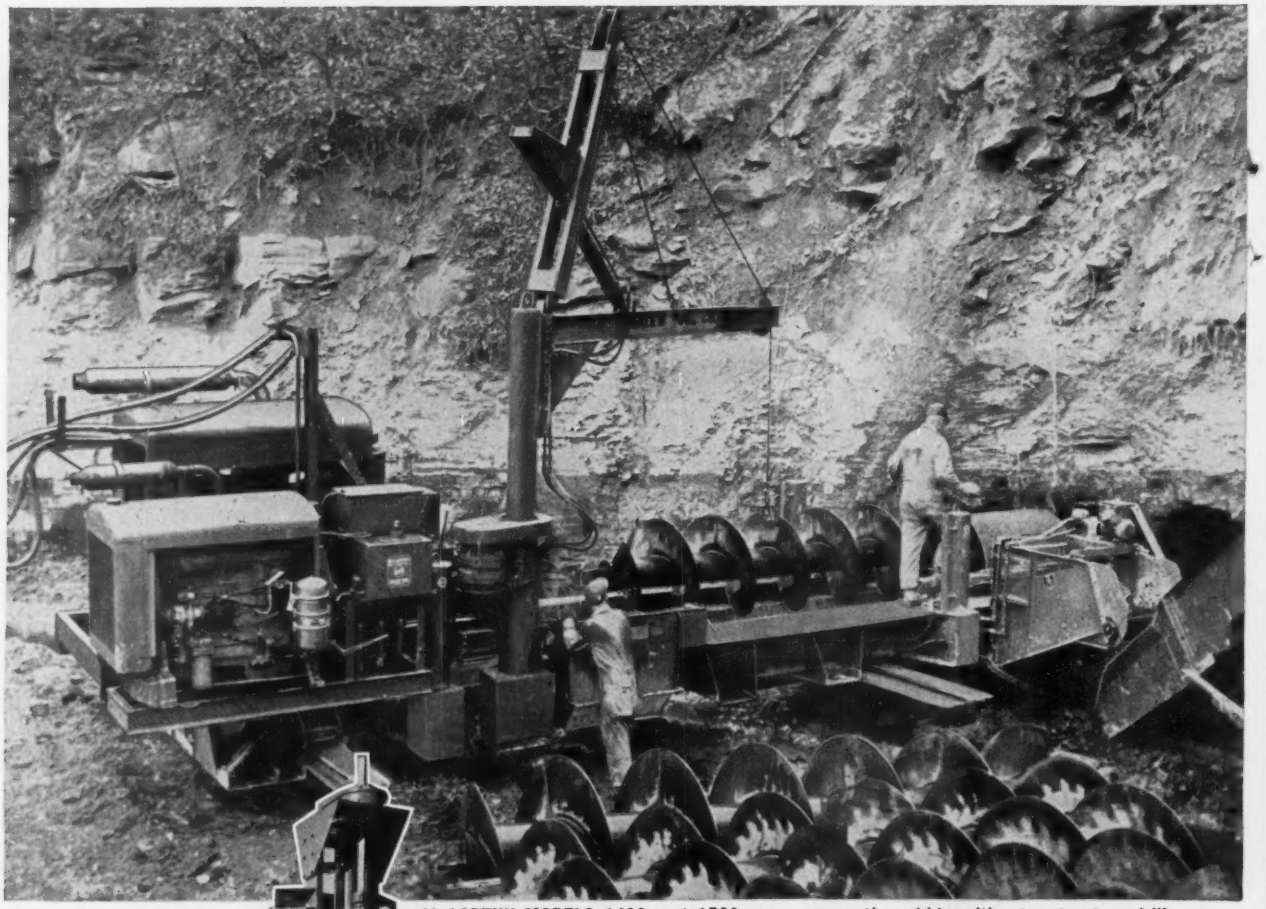
STEARNS MAGNETIC PRODUCTS

635 South 28th Street • Milwaukee 46, Wisconsin

Phone EVergreen 3-4800 Direct Distance Dialing Code 414

Profit with Stearns — First with Ceramic Magnet Separators for Industry

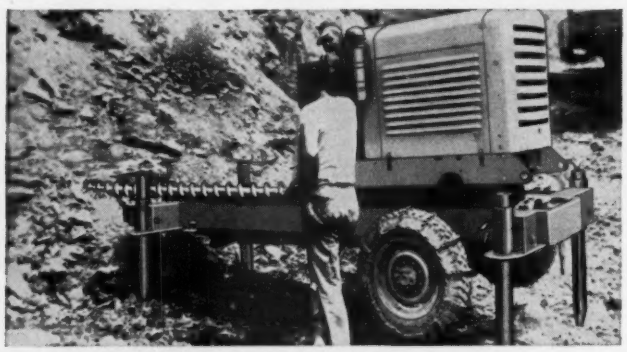
SALEM DRILLS



McCARTHY MODELS 1400 and 1500 move on captive skids without a tractor; drill hole-over-hole; handle augers as large as 42″; produce more coal at less cost than any other means. See Bulletin CD-100.

McCARTHY VERTICAL DRILLS

One of the fastest drills in the world for work in mining, blast holes, coal testing and construction. Hole diameters to 24 inches. See Bulletin M-100.

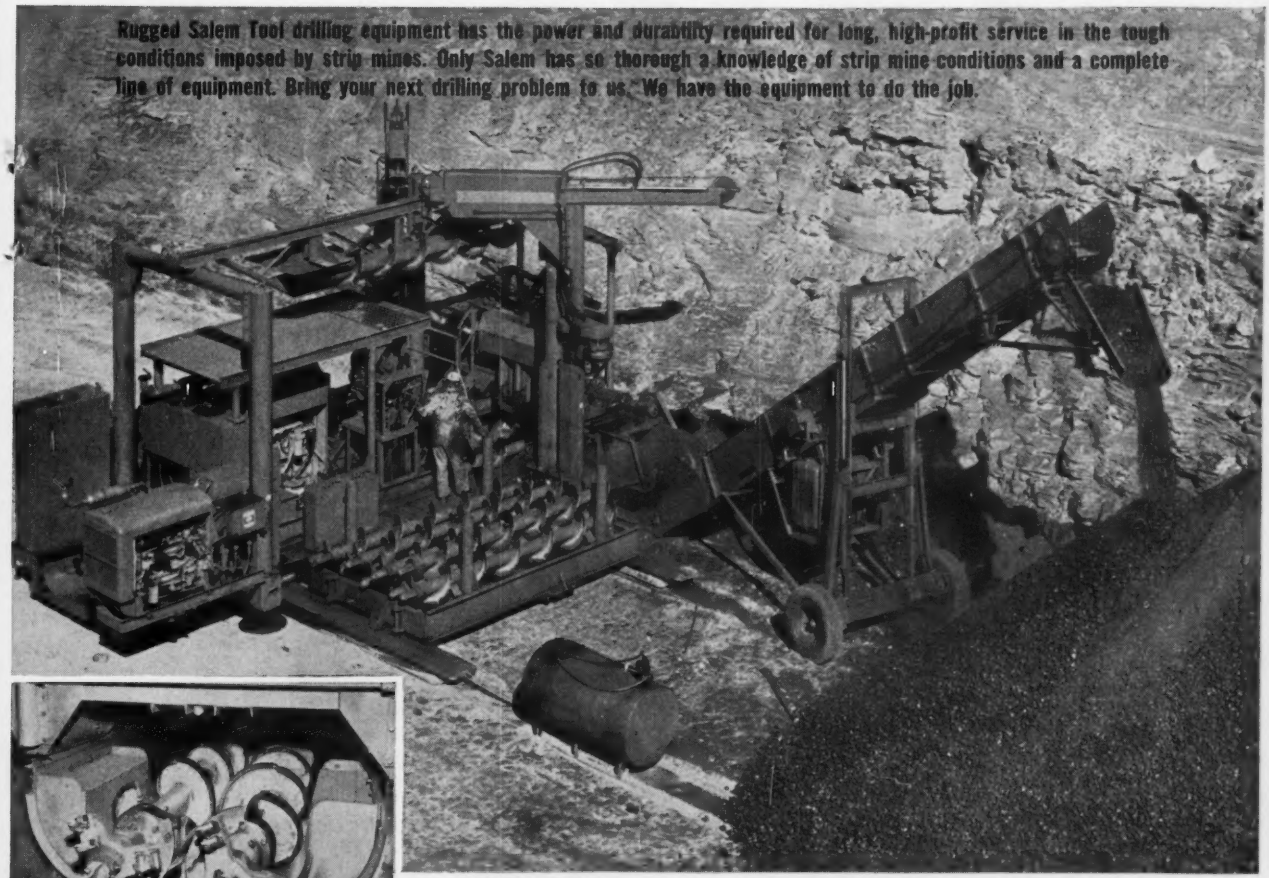


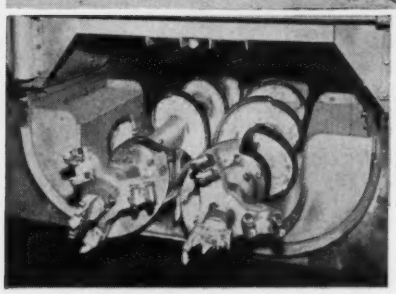
McCARTHY HORIZONTAL BLAST HOLE DRILLS

A complete line of rugged, self-propelled and truck-mounted drills. Fast setup. Maximum footage per day. Handles augers up to 12 inches. Drills to horizontal depth of 150 feet. See Bulletin M-105.

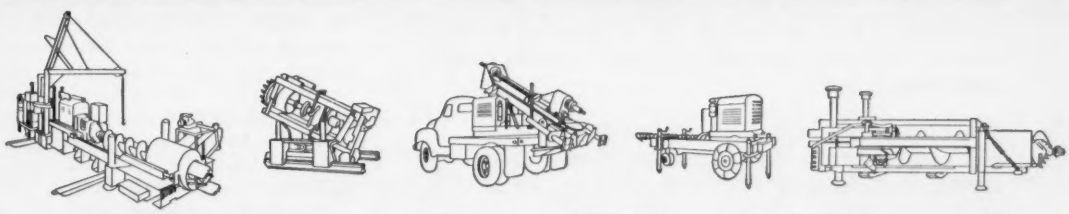
cut coal costs!

Rugged Salem Tool drilling equipment has the power and durability required for long, high-profit service in the tough conditions imposed by strip mines. Only Salem has so thorough a knowledge of strip mine conditions and a complete line of equipment. Bring your next drilling problem to us. We have the equipment to do the job.





DUAL AUGER handles two opposite rotating augers up to 30" diameter; has automatic coupling of augers; moves in any direction under its own power; brings low seam coal into the profit class. See Bulletin DA-100.



THE SALEM TOOL COMPANY

763 SOUTH ELLSWORTH AVE. · SALEM, OHIO

STOP

CABLE FAILURE

Put the "hex" on off-track mining machine down time .... with the new Collyer Twin Type G Portable Power Cable with hex-shaped parallel conductors. This construction *locks conductor assemblies in place,* prevents twisting and shifting, assures longer flexing life . . . AND LONGER CABLE LIFE!

Insulated with heat-resistant natural rubber . . . sheathed with Collyer's tougher, more durable Neoprene sheath compound to give greater resistance to abrasion, tearing, crushing. Compression cutting is "hexed", too, by natural rubber insulation!

Write today for complete information on how this new cable can put a stop to resplicing down-time and replacement overhead.

Collyer

COLLYER INSULATED WIRE CO.
257 ROOSEVELT AVENUE
PAWTUCKET, RHODE ISLAND

power, the series supplies an engine range of 7-40-hp gasoline and 5-30-hp diesel. Other characteristics include 1- , 2- , 4-cyl 4-cycle overhead valves; a washable, dry-element air cleaner and an optional oil-bath air cleaner. Besides being compact, having small weight and size for output, the engines have 60 fewer electrical connections in the exciter and regulator. On the 1-cyl diesel model, low oil-pressure cutout is standard; it is optional on all others.

The first units, including 1- , 2- and 4-cyl models ranging from 3 to 15 kw, are available now, with the balance scheduled for production by early spring.

Pictured here is one of the first units, Model 5JB-1R, a 5,000-w gasoline electric generating plant, 2-cyl, air cooled.

Onan, Div. of Studebaker-Packard Corp., 2515 University Ave. S. E., Minneapolis 14, Minn.

Low-Cost Short-Arc Package

A complete outfit for "Sigma" Short Arc welding, used for pipe fabrication and general sheet-metal welding, sells for $1,475, including power supply.

The SWM-14, which Linde asserts is the lowest-cost on the market, includes: compact wire-feed control unit with centrifugal governor; 200-amp power supply with variable voltage and inductance controls: 14-oz, 200-amp torch; shielding as regulator-flowmeter; 12-in wire-spool mount; torch-service lines and 12½ ft of argon hose and control cable.

The 40-lb control unit, which can be removed from the power supply for field operation, may be purchased separately for $690. Also available separately is the ST-6 torch at $125.

Short Arc Welding, developed by Linde in 1958, short-circuits many times per second, depositing electrode metal as tiny drops instead of the usual spray. It produces a uniform burnoff rate and

Shock-Fortified Firestone Tires Mean

LESS DOWNTIME and MORE RECAPS!

Firestone SUPER ROCK GRIP DEEP TREAD tires help keep your coal trucks working at peak production. With 50% deeper treads of Firestone Rubber-X, they fight off rubble cuts and bruises. This tough tread rubber goes all the way through to the cord to give a long-wearing base for extra money-saving recaps! The Shock-Fortified cord body of bonus-ply nylon guards against impact breaks. Get rugged Firestone tires — plus fast, on-the-job service for all your coal-hauling equipment—from your Firestone Dealer or Store.

Always Specify Firestone Tires When Ordering New Equipment.

Firestone

FIRST IN OFF-THE-HIGHWAY TIRE NEEDS

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McDowell FASTLINE

Portable Steel Pipe with Integral Couplings

for

- compressed air lines
- water lines

in modern mining operations

EASY INSTALLATION

Couplings are assembled and tightened by hand even in darkness. No special tools needed.

LIGHT WEIGHT

One man can handle 30-foot section weighing 40 lbs. Saves time moving from one location to another.

LEAKPROOF

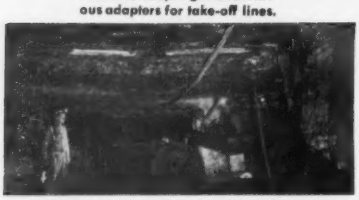
Leakproof gasket is built in; will not dislodge during transportation, installation or disassembly.

FLEXIBLE

Easily follows branch lines, sharp radius curves and natural contours. Ceiling and wall mountings are readily installed.

AVAILABLE IN SIZES:
2-3/8", 2-7/8" AND 4" O.D.
Couplings adaptable to standard pipe

Fast-Line couplings have various adapters for take-off lines.



Light weight of pipe permits mine roof hanging.

Write for full details and literature

McDowell MANUFACTURING COMPANY

PITTSBURGH 9, PA.

Quality Metal Products Since 1900

pinpoint control of arc heat, permitting quality welds on all sheet-metal thickness without burnthrough.

Linde Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17, N. Y.

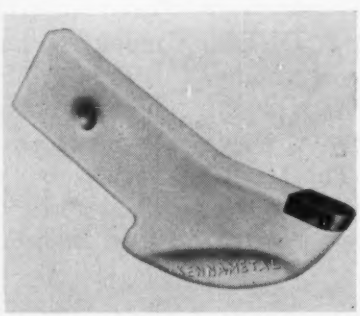
System Detects Cracks, Flaws and Leaks

A low-cost system for detecting surface cracks, flaws, defects and porosity in metallic or nonmetallic solids is called the "Seal-Lock Fluorescent Detector."

The system uses black light to activate highly-sensitive fluorescent materials. Defects appear as extremely bright, glowing lines or spots and indications are highly visible. Based on the proven principle of penetrating capillary forces, the device employs only water-soluble materials that are easily and completely removed with a simple water rinse or bath.

Because of its extremely high sensitivity, the detector will find minute defects that cannot be detected with ordinary penetrants. In addition, its rapid penetrating and developing ability can cut inspection time by up to 80% and, in most cases, the complete inspection procedure takes only from 3 to 5 min.

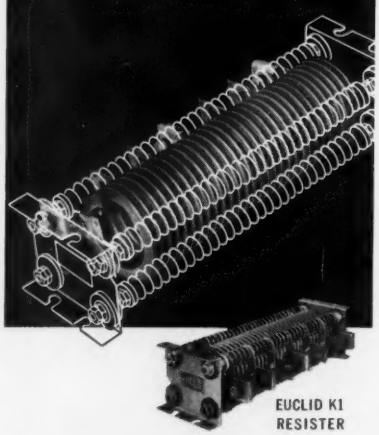
U. S. Casting Repair Corp., 6432 Edmund St., Philadelphia 35, Pa.



Bit's 2-In Gage Cuts Added Clearance

Promising to improve the performance of low-coal, auger-type continuous miners, the Style U23P mining-machine

IT FLOATS



In the Euclid K1 Resistor, the entire resistor coil floats on its four insulated supporting rods. This exclusive feature allows the coil to expand and contract with no distortion or buckling, even when subjected to the most severe mill-duty service. The Euclid K1 Resistor has all steel and mica non-breakable construction.

Contact your Euclid Representative and arrange to install a Type K1 Resistor on your heaviest duty application. Ask for **Bulletin 3004.**

We specialize in designing the control system best suited to your individual needs. Our services are yours for the asking.

CUSTOM ENGINEERING IS OUR BUSINESS. WHAT'S YOUR PROBLEM?

EX-30A

The EUCLID Electric & Mfg. Co.
MADISON · OHIO

Whatever your repair job needs . . . Leman has the equipment and know-how that saves you money . .

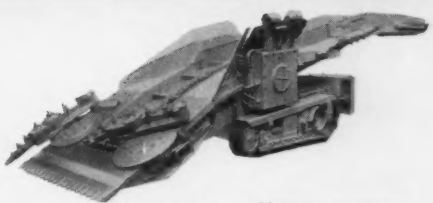
42" dia. bearing surface of huge turntable from Continuous Miner is remachined to precision OEM specifications in Leman's Shop.

Get Leman to handle your repair work . . . save time and money with guaranteed results. Leman restores worn or damaged equipment to original condition . . . gives you new equipment performance at a fraction of ordinary replacement costs. Leman's fully equipped, modern plant assures you of fast, economical repairs on any make or model of mobile loading and mining machinery or electric locomotives.

Heaviest equipment made "as good or better than new" . . . old equipment converted to latest models . . . new parts designed for special needs . . . only genuine OEM replacement parts used. Just a few of the reasons why Leman has led in heavy mining machinery repairs for nearly 40 years . . . good reasons too, why it will pay you to consult Leman when you want to save money on your own repair work.

Ask About Fast Pick-up and Delivery Right To The Job Site.

Phone or Write for Prompt, Courteous Service.



Heavy, continuous mining equipment leaves Leman's Repair Shop in "Good-as-New" condition. Gets back on the job in record time.

LEMAN MACHINE COMPANY

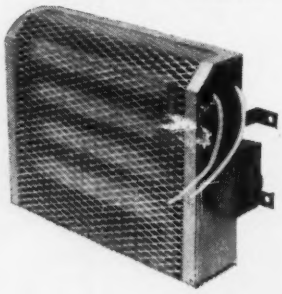
BOX 236, PORTAGE, PENNA. **PHONE PERSHING 6-3731**

Guyan®
HEATERS

FOR CONFINED AREAS

ALSO AVAILABLE IN FLOOR TYPE

WALL TYPE



RUGGED
and ECONOMICAL TOO!

WHEN the space is hard to heat — such as a crane or locomotive cab, a pump house or small office — a GUYAN natural convection heater is the answer. It is a DEPENDABLE, LONG-LIFE HEATER consisting of corrosion-resistant aluminum chromium wire — wound on ceramic forms — and mounted within expanded steel housings.
GUYAN Heater Units are ruggedly built to stand the hard service that is customary in tough industrial applications. Available from 1,500 thru 7,500 watts for 110, 220, 440 volts DC or AC. Priced right — more economically than you might think — and lower than you can make your own. Write for complete information.

GUYAN MACHINERY CO.
LOGAN, WEST VIRGINIA

Guyan®
HEATERS

A Thousand of these Stoppings in Use
AT PEABODY UNDERGROUND MINES

★ AIRTITE DEMOUNTABLE STOPPINGS have been in use for over 2 years.

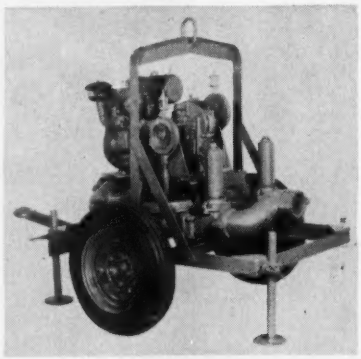
"Only 4 man-hours are required per stopping against approximately 52 man-hours for temporary wood stoppings and following up concrete block stoppings . . . a 1200% saving," says Joseph Craggs, Field Superintendent of Operation.

NEW PRODUCTS, INC.
917-919 SO. WEBSTER ST. • • • TAYLORVILLE, ILL.

bit features a 2-in gage which cuts added clearance. There is less drag on the auger scrolls. This means faster cutting, more tons per shift and lower power consumption.

In addition, test operations show the percentage of coarse coal is increased and fines are reduced when using this bit, the manufacturer notes. Under suitable conditions, the new bit can also be used on cutting machines.

Kennametal Inc., Latrobe, Pa.



Gas-Powered Diaphragm Pumps

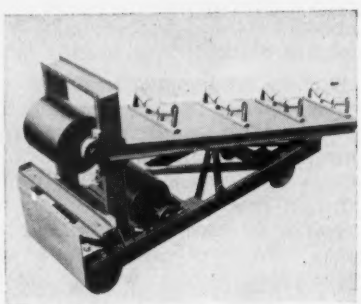
A new line of gas-engine-powered diaphragm pumps includes both single and double diaphragm types in 14 model sizes with capacities from 1,000 to 17,000 gph. Also many air-cooled, diesel-power models are offered.

Suction and discharge openings range from 2-in-single on Model 2D-8 to 4-in-double on the 24 D (photo). The larger, double-diaphragm pump, is powered by a 9-hp gas engine.

The pump's worm-gear drive provides a one-step speed reduction, eliminating an intermediate speed reduction on either power source or pump. Worm and worm gear operate in a constant oil bath.

Both swing- and ball-type valves are available on the new line and a lifting eye is provided.

Rice Pump & Machine Co., Belgium, Wis.



BELT TRIPPER—Built for high-capacity stockpiling operation, this heavy-duty cable-propelled belt tripper permits dis-

1961
OUTSTANDING ACHIEVEMENT

WITH OVER 325 COAL PREPARATION PLANTS INSTALLED IN THE LAST 40 YEARS, IT IS SIGNIFICANT THAT EVERY ONE HAS PROVED TO BE A PROFITABLE BUSINESS VENTURE

McNALLY PITTSBURG

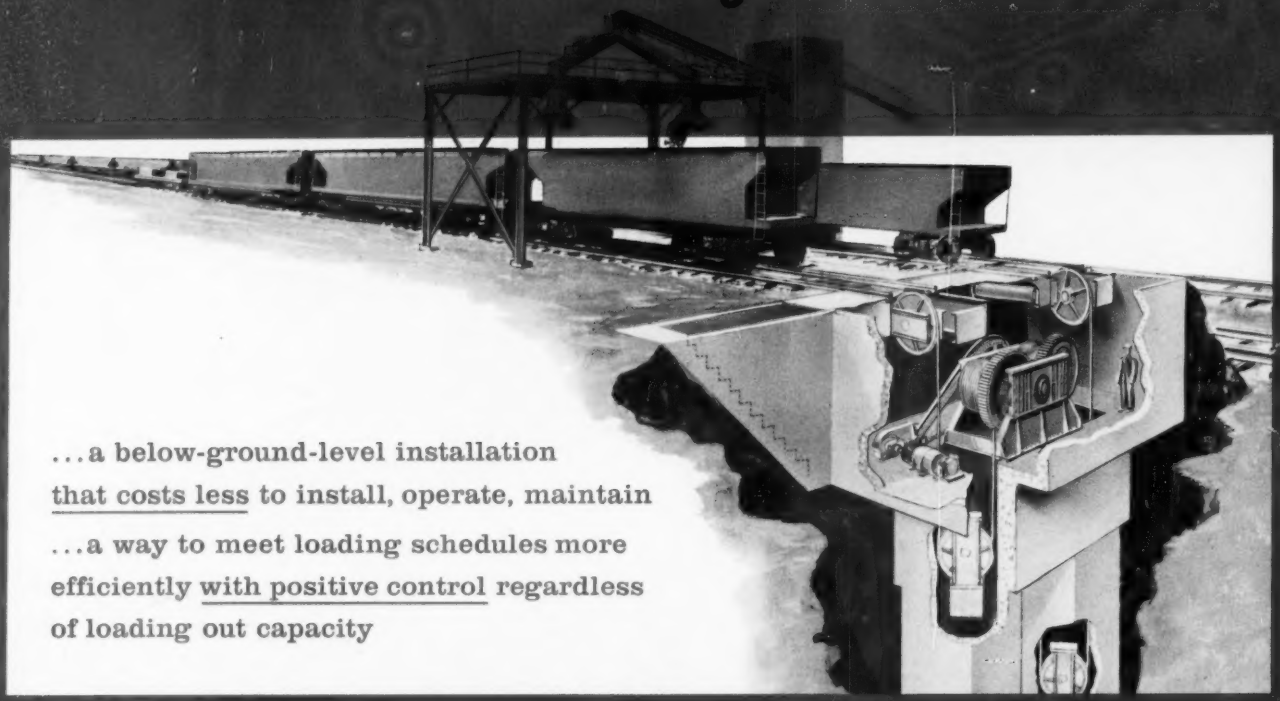
MANUFACTURERS OF EQUIPMENT TO MAKE COAL A BETTER FUEL

PITTSBURG, KANSAS • WELLSTON, OHIO

...to operators who are thinking about new plants...additions to existing plants ...or replacement of equipment in '61, we offer the service of our consulting staff without charge or obligation.

Printed in U.S.A.

NEW McNally CAR HAUL



...a below-ground-level installation that costs less to install, operate, maintain

...a way to meet loading schedules more efficiently with positive control regardless of loading out capacity

The new McNally below-ground-level car haul offers you better, more efficient car handling for less money than ever before possible. It provides simple, fast, positive control of cars on sloped tracks as well as level track installations. The new design incorporates long life, anti-friction bearings with six less sheaves. Also, it completely eliminates need for counter-weight tower. Cable tension is greatly reduced by means of a nine double wrap drum. You get longer cable life due to direct line pull on hauling cables. All components are ruggedly built and designed for years of profitable service with minimum maintenance.

The new car haul can handle a trip of up to 48 cars on two tracks. It can pull 70-ton cars through the loading point for continuous filling, and at the same time pull the trip of empty cars on the adjoining track for subsequent loading during the next cycle. When a trip on one track is loaded and removed from the haulage system, loading begins on the adjoining track by reversing the system. The new McNally car haul consists of wire rope on two tracks reeved through sheaves to a variable-speed hoist. The cable continues into a double-drum hoist which operates with a constant number of drum wraps.

For a more profitable car haul operation, contact the "Man From McNally"—he knows coal from the ground up. He can offer you a below-ground or surface installation that will perform consistently better and save you money. Or for any information on coal preparation equipment, contact McNally. Fill out the coupon for complete details on the equipment of your choice. Do it today.

MAIL THIS COUPON

McNally Pittsburg Mfg. Corp., Pittsburg, Kansas

Gentlemen:

Please send me information about the following equipment:

- ☐ Car Hauls
- ☐ Automatic Sampling
- ☐ Crushers and Breakers
- ☐ Coal Preparation Manual
- ☐ Thermal Dryers
- ☐ Coal Cleaning
- ☐ McNally Flowdryer
- ☐ Conveyors
- ☐ Centrifugal Dryers
- ☐ Complete Coal Preparation Plants

NAME_____ TITLE_____

COMPANY_____

CITY_____ STATE_____

C

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MANUFACTURERS OF EQUIPMENT TO MAKE COAL A BETTER FUEL

McNally Pittsburg Manufacturing Corporation

Manufacturing Plants:
Pittsburg, Kansas • Wellston, Ohio

Engineering and Sales Offices:
Chicago • Rio de Janeiro • New York City
Pittsburg, Kansas • Wellston, Ohio

the SWENCH® is a wrench like no other — and will work where no other can. It's the world's first manual impact wrench. Loosens frozen nuts and bolts in seconds . . . tightens with precise accuracy every time. SWENCH is completely portable . . . needs no outside power — yet multiplies torque many times. It safely handles more bolt sizes than any comparable power wrench, but costs less. Read how you'll save with the SWENCH:

SWENCH® speeds repair jobs for trucking firm

In every truck servicing garage, like one operated by a big mid-western trucking firm, transmission and differential repairs are common — and tough.

Removal of the nut from the differential torque divider or transmission used to take two men from 2 to 3 hours with a wrench and sledge and usually the nut was damaged beyond use.

Then, along came the SWENCH. One man — as few as 4 impacts and the nuts are off — loose in minutes instead of hours . . . undamaged. Figure what the SWENCH can save you with the same kind of performance!

The hand-operated SWENCH works anywhere — carries its power built in. Exerts many times the energy needed to pull the handle — gives you more power with greater safety — even in hard-to-reach spots.

Six models cover bolt sizes from ½" to 2½". For the full story on SWENCH, how it works, what it costs, how it saves, see you local distributor, or write:

AD NO. 32-36

A FEW DISTRIBUTOR TERRITORIES ARE STILL AVAILABLE

DISTRIBUTED IN CANADA BY:
CANADIAN CURTISS-WRIGHT LTD
TORONTO & MONTREAL CANADA

MARQUETTE DIVISION
CURTISS-WRIGHT
CORPORATION
1145 GALEWOOD DRIVE • CLEVELAND 10, OHIO

*

Completely Metal-Enclosed — no exposed insulators subject to damage.

*

Compound-Filled — to give added insulation value at peak of stress cone where needed most, helps keep moisture out of coupler.

*

Threaded Closing Ring engages contacts smoothly . . . keeps coupler closed. No jamming of misaligned contacts . . . no levers to snag or open unexpectedly.

Impacts and abrasion make *complete metal enclosure* a must for high-voltage cable couplers in mining service. Compound filling of end bell prevents corona and insulation-cutting ozone formation on surface of conductor.

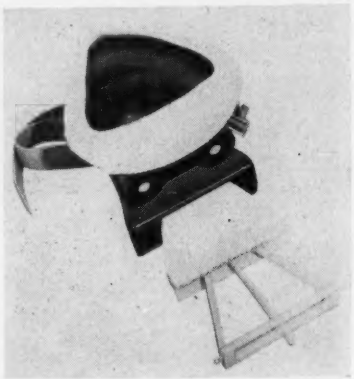
PLM Cable Couplers give these advantages and more. They enable 7500-volt a-c power to be extended to working equipment easily, dependably, *safely*. Many hundreds in continuing service wherever mining is performed are assurance of built-to-last electrical and mechanical design.

PLM Couplers are supplied as plug and socket, for foot, flange or sled mounting, or as 2, 3 or 4-way junction box assemblies. Male and female contact-insulator assemblies interchangeable. *Write for new bulletin 375.1.* PLM Products, Inc., 3881 W. 150 St., Cleveland 11, O.

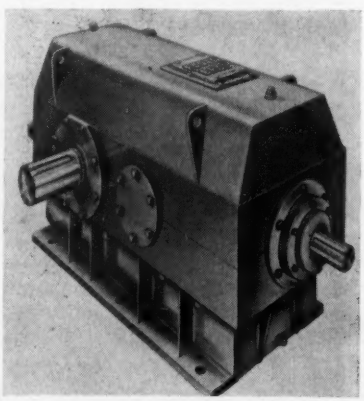
CABLE FITTINGS • TERMINATORS • SPLICING KITS

CABLE PLM COUPLERS

charge of material to points along the length of a conveyor system. It has been designed for installations where a power-propelled tripper is required but where electrical conductors or trolley wires are undesirable. A 5,500-lb unit with a 36-in-wide belt, it measures 18x4½x7 ft and is track-mounted. A single wire rope, reeved through the tripper and a stationary sheave, moves the tripper forward or reverse. It is driven by a winding machine at a travel speed of about 30 ft per min. Finco, Inc., Aurora, Ill.



RESPIRATOR—An anatomically-designed respirator, the 600A "MonoMask" automatically shapes to the face for greater comfort. The unit has one-piece, resilient-rubber face-piece featuring tapered, "feather-edge" contact all around. USBM-approved for protection against dusts, pneumoconiosis-producing and chronic-acid mists, it incorporates a high-quality single filter of treated felt that gives extra long service. Positive-action inlet and outlet valves assure uninterrupted ease of breathing. Packed in a sturdy plastic case, the outfit includes a molded-rubber headband and five extra filters. Willson Products Div., Ray-O-Vac Co., Reading, Pa.



GEAR DRIVES—A new line of heavy-duty right-angle shaft-enclosed helical gear drives with high-strength fabricated-steel housing is offered in 45 sizes in double and triple reduction types. Capa-

YOUR SUPERMARKET FOR MINING MACHINE REPLACEMENT PARTS

. . . 40 YEARS OF SERVICE AND STILL GROWING!

More Than 100,000 Highest Quality Parts Now in Stock

Not even your supermarket stocks more items than Penn Machine! Here, ready for fast off-the-shelf delivery, are more than 6,000 different types and sizes of gears, sprockets, shafts, castings and other replacement parts for all mining equipment . . . *including the newest.*

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A recently completed $500,000 plant expansion and equipment modernization program enables Penn Machine craftsmen to produce a complete range of parts faster and with even more precision. And, a completely new heat treating and Magnaflux inspection section assure you of longer-lasting, defect-free parts.

Geared to Serve You Fast, Dependably

Call, wire or write. Penn Machine packs and ships that vital replacement part off to you within a few hours.

PENN MACHINE COMPANY

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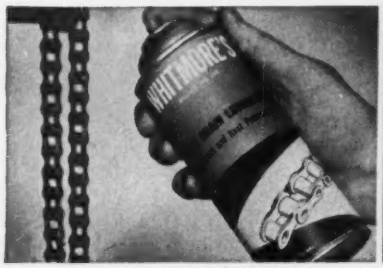
TRIAL SAMPLES
Of World-Famous WHITMORE'S Lubricants



OPEN CHAIN LUBRICANT INCREASES CHAIN LIFE UP TO 300%

Penetrates, lubricates, prevents rust. Lubricates deep into chain linkage to reduce friction on pins, rollers, bushings, pressure surfaces. Corrosion inhibitor prevents rust in vital working mechanisms. Lubricates close-tolerance internal surfaces to increase chain life up to 300%. Highly recommended for all climatic conditions to stop rust and corrosion even in salt atmospheres.

Packaged in handy 16 oz. aerosol spray-on containers or in bulk—send for a free trial sample.

ANTI-FRICTION COMPOSITIONS HAVE NO MELTING OR DROPPING POINT

Packaged in 14½ oz. cartridges for handy application with lever-type cartridge guns for constant protection to roller, ball, sleeve bearings and sliding surfaces in "hot" bearing applications or in areas with high ambient heat. Exclusive formulas have no melting or dropping point; moisture resistant; will not wash out; exceptional metal adherence properties; temperature reducing qualities; high extreme pressure values. Available in two grades. Whitmore's Anti-Friction Composition No. 1 (light density), recommended for high speed, high temperature applications. Anti-Friction Composition No. 2 (heavy density), for low-speed high-temperature applications or loosely-fitted bearings. Specify No. when requesting free trial sample.

68 YEARS OF LEADERSHIP LUBRICATING THE FOLLOWING:

- Open Gears, Dipper Sticks, Cams
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- Hydraulic Units, Torque Converters

Est. 1893
THE WHITMORE MANUFACTURING CO.
LUBRICATING ENGINEERS
CLEVELAND 4, OHIO • VULCAN 3-7272

THESE NAVCO AIR VIBRATORS

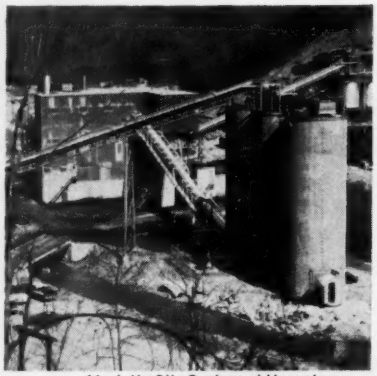
CUT UNLOADING TIME 20% ON CAR DUMPERS

Navco Long Stroke Air Vibrators eliminate manual car clean-out. These 6 Navco BH-4's are installed with a free-floating spring arrangement for complete vibration freedom. Unusual vibrator mounting location and method eliminates car being returned to half position for manual clean-out. Navco's patented "one-piece" design cuts vibration maintenance downtime and repairs—requires no costly spare parts inventory.

For Catalog 307, write Dept. CA.

NATIONAL AIR VIBRATOR CO.
435 Literary Road Cleveland 15, Ohio

cut coal handling costs...
stop ground storage losses...
save valuable space
with a



Marietta Silo System at Hampton #4 Plant, Westmoreland Coal Company, Clothier, W. Va.

MARIETTA SILO
STORAGE SYSTEM

Marietta industrial coal silos provide rugged storage anywhere . . . at the mine . . . in the yard . . . at the plant. That's because they're designed to store coal safely and to fit perfectly into a materials handling system engineered to your precise requirements. For example, run of mine coal can be moved from your mine directly into your surge silo, then to cleaning plant and on to storage silo, truck, barge or railroad car . . . or by conveyor belt from mine to plant site . . . with virtually no expensive hand operation. Marietta storage systems save space, too, because they can be installed anywhere . . . and support heavy super structures and equipment loads. Marietta Silos eliminate fire hazards, cut insurance rates. For safe, economical coal storage . . . anywhere . . . plus fast handling, no storage loss and increased profit, let Marietta engineers design a system to meet your exact needs . . . for information, write

Marietta
AM CONCRETE DIVISION
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Marietta, Ohio
Representatives in principal cities

More companies choose CMI Continuous Centrifugal COAL DRYERS than all others combined!

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TIOGA COAL CORPORATION
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CONSOLIDATION COAL COMPANY
THE NORTH AMERICAN COAL CORPORATION
JEWELL RIDGE COAL CORPORATION
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CLINCHFIELD COAL COMPANY
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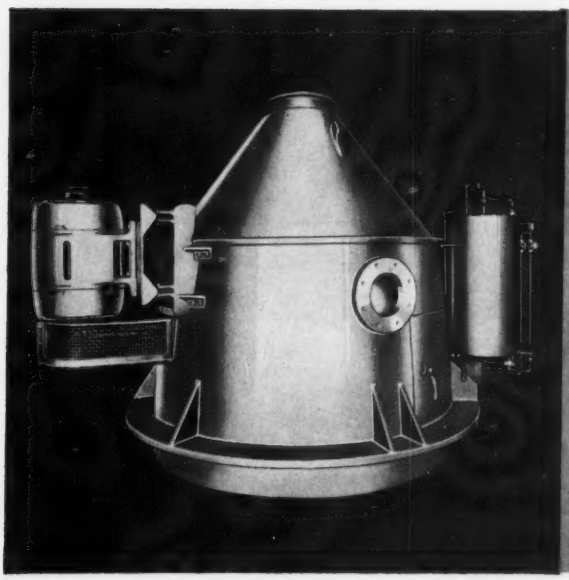
COAL PROCESSING CORPORATION
AYRSHIRE COLLIERIES CORPORATION
CRUCIBLE STEEL COMPANY OF AMERICA
RICHWOOD SEWELL COAL COMPANY



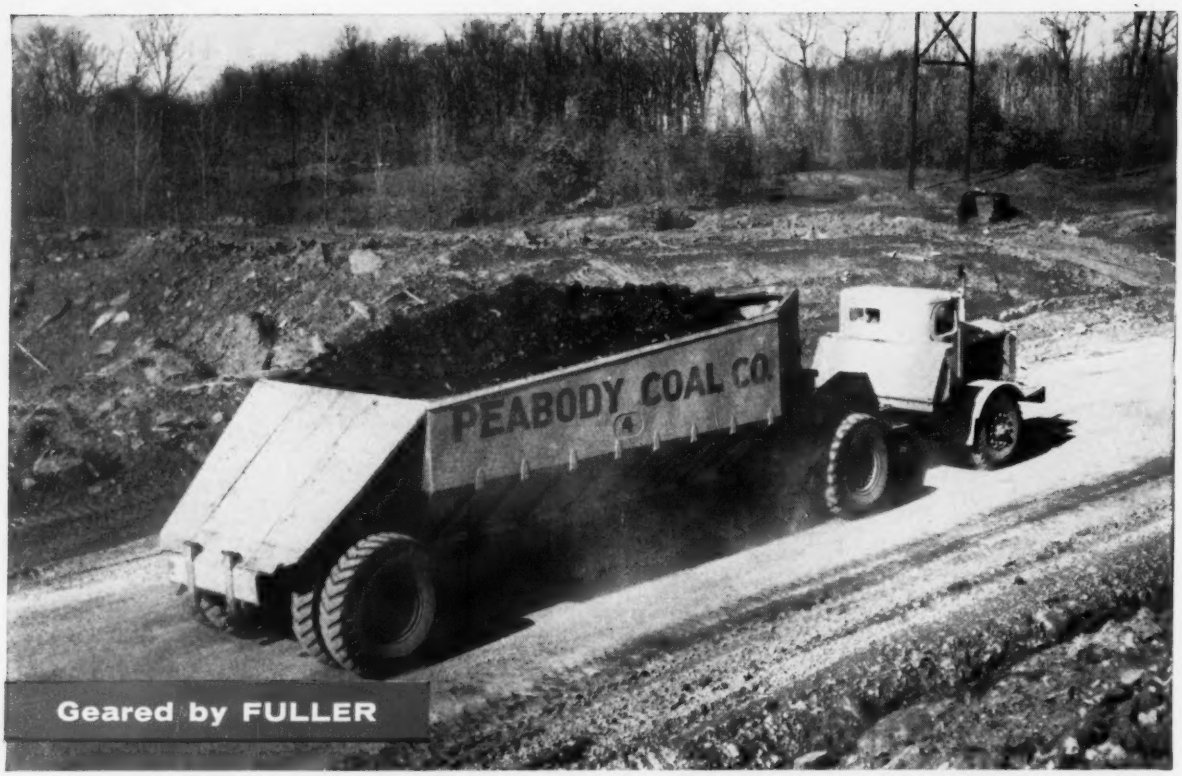
LISTED ABOVE ARE ONLY A FEW OF THE HUNDREDS OF FIRMS WHICH HAVE ONE OR MORE CMI DRYERS IN CONSTANT OPERATION. THESE COMPANIES ARE ENJOYING THE LOWEST POWER CONSUMPTION COST — LOWEST MAINTENANCE COST — LOWEST "PER TON" COST.

Advance your operation profits with a CMI Dryer, the dryer which meets or exceeds every performance estimate . . . a dryer which can pay for itself within a single year, depending on the project used.

Please write. Let us send you literature and let us tell you about the latest improvements in this model.

CENTRIFUGAL & MECHANICAL INDUSTRIES, INC. CMI

146 President Street • St. Louis 18, Missouri



Peabody Coal Company of St. Louis, Missouri hauls 52-ton loads from their River King Mine in Illinois with *Fuller-equipped* Model 129TDT Euclid Tractors. These ten Euclid Tractors pull Model 124 Wagons with 61 cubic yard capacities. Engines in the Peabody Euclids are Cummins 350 hp V8 and NRTO 330 hp diesels and 12V71 336 hp Detroit Diesels. All drive through Fuller R-1160 ROADRANGER Transmissions and 14.96:1 axles.

Designed for Coal Hauling Equipment

Model R-1160 ROADRANGER Transmissions

Faster, smoother operation, greater fuel economy, faster cycles, and longer gear and bearing life are offered by the Fuller R-1160 ROADRANGER Transmission.

Check these advantages:

- No gear splitting—nine selective ratios evenly and progressively spaced (average of 38% steps).
- Easier, smoother shifting—one shift lever controls all nine forward and two reverse speeds.
- Pre-selected range shifts — automatic and synchronized, with range selector located on the shift lever.
- Quicker up shifts for constant operation in peak horsepower range — assured by Fuller air powered countershaft inertia brake.
- Prolonged gear and bearing life—Pressure Lubrication and Filtration System provides positive lubrication and maintains clean lubricating oil to prolong gear life.

Gear	Ratio	% Step	
9th	.75	33	
8th	1.00	39	HIGH RANGE
7th	1.39	40	Reverse 3.31
6th	1.94	34	
5th	2.59		
RANGE SHIFT			
4th	3.48	39	
3rd	4.84	40	LOW RANGE
2nd	6.76	34	Reverse 11.53
1st	9.02		

Weight: 1133 lbs. Length: 44 21/32"
Clutch Housing Size: SAE No. 1
Oil Capacity: 35 pts.; w/filter 38 pts.
Approximate Engine Size: 1160 cu. in.

FULLER TRANSMISSION DIVISION

EATON MANUFACTURING COMPANY

KALAMAZOO, MICHIGAN

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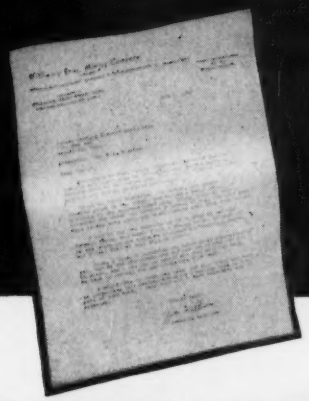
A PRODUCER IN KENTUCKY SAYS:

"WE CAN SCREEN ANY COAL IN ALL WEATHER WITHOUT ANY SCREEN BLINDING WHATSOEVER"



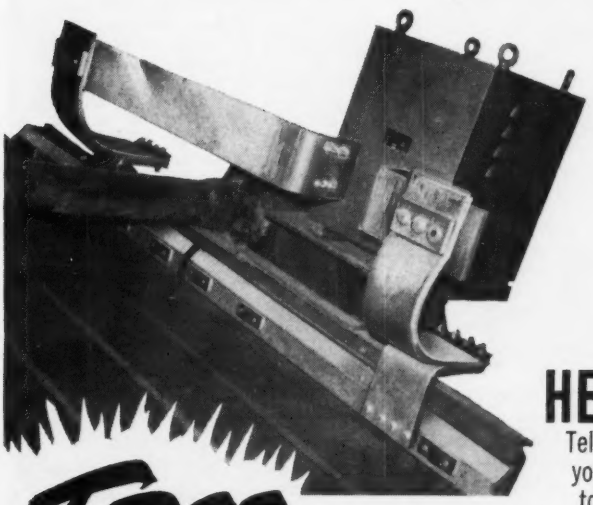
doing the job with

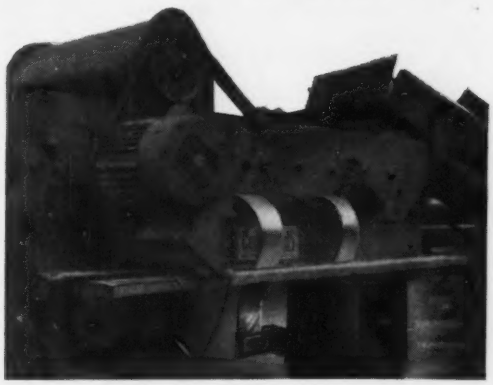
CONVERTA-SCREEN

→ the simplest, surest construction

→ the lowest power consumption

→ the lowest maintenance





HEAT ANY SCREEN, ANY DECK with proven equipment. Tell us what vibrating screens you have and we will show you a modern custom-built CONVERTA-SCREEN installation to increase production and cut operating costs.

FREE 30 Day Trial

in your plant will let you determine the value of CONVERTA-SCREEN under specific local conditions. Write or call for additional information. Our service representatives will get the answers to you right away. We are in DDD area 216, telephone TE 3-8624 and TE 3-8548. TWX MSLN 044.

SCREEN HEATING

Transformers

INCORPORATED

428 Erie St. South • MASSILLON, OHIO

HIGH SPEED DUMPING

through full 360° turn with the

NOLAN

ROTARY CAR DUMPER

Moves coal faster, safer

MORE PROFITABLY!

Features:

- Fully Automatic with Selective Manual Control
- Designed for Today's High Capacity Mine Car
- Gear Driven through Flame Hardened Gears
- Complete with Base Frame, Dump Sheets, and Liner Plates
- Anti-friction Bearings Throughout
- Wide Faced Dump Rings of Special Alloy Steel
- Equipped with Nolan Patented Cushioned Rail Aligning Stop
- Embodies 50 years Experience in Mine Car Dumping and Control

WRITE FOR FREE CATALOG

Illustrating and describing complete NOLAN line of Mine Car Dumping and Control Equipment

NOLAN

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E. C. Horne Machinery Co., 1726 Champa Street, Denver 2, Colorado

Frank C. Memmott, P.O. 154, Castle Gate, Utah

J. L. Thomas, 429 S. 24th St., Birmingham 5, Ala.

John North Associates, PO. Box 105, Harbert, Mich. (Chicago District)

Levitt Safety Limited, Toronto 10, Canada

THE NOLAN COMPANY

106 Pennsylvania St., Bowerston, Ohio

cities of the Maxi-Power series run to 1,460 hp and 2,210,000 in lb, torque. Standard gear ratios are from 9.39:1 up to 211.0:1. Complete information, specifications and performance details offered in Engineering Catalog MPB. Foote Bros. Gear & Machine Corp., 4545 S. Western Blvd., Chicago 9, Ill.

DE-ICER—With winter just around the corner, a new product with 30 times more thawing power than salt and 10 times more than flake calcium chloride, has entered the market. Called "Flex Melt," it leaves no residue or deposit and is said to be absolutely harmless. Consisting of heat-generating pellets, it goes to work immediately upon contact with ice and snow. Flexrock Co., 3601 I. Filbert St., Philadelphia 1, Pa.

WELDING AND CUTTING—Two new oxy-acetylene welding and cutting outfits are now being marketed at special low prices. Besides the welding torch and cutting attachment, both outfits contain three welding heads for welding metal up to ⅜ in thick, oxygen and acetylene regulators and hose, friction lighter, goggles and instructions. The light duty "One Hundred," costing $100, includes a cutting nozzle for slicing 2-in steel while the medium-range "One Thirty," priced at $130, features a nozzle for cutting up to 4 in. Linde Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17, N. Y.

BUCKET TEETH TIPS—With added steel "out front" in the wear zone, two new Caterpillar tips are said to last up to twice as long in abrasive materials as the firm's shorter tips. The "runner" type is for use with wheel loaders and the "digger" designed for use on track-type machines. Both are flat on one side and ribbed on the other. Runner tips are mounted on the bucket rib side up; digger type, rib side down. Because the latter side wears slightly faster than the flat side, the tip remains sharp throughout its

PROX SETS A NEW STANDARD FOR PRODUCTION WITH

THE STURDIEST CUTTER BAR EVER MADE

HEAT-TREATED, HIGHEST GRADE ALLOYS, WELDED FOR GREATER STRENGTH

Prox Cutter Bars are engineered for extra-long service, quick and easy maintenance, added safety. All parts that are subject to wear, are easily and economically replaced for continual, like-new performance. This means less down time, increased savings, higher profits. Prox Cutter Bars are versatile, too, designed to accommodate three cutter heads—roller, semi-circle and semi-circle shoe types. No matter whose mining machinery you're using, there is a Prox Cutter Bar to fit it. Why not check and see?

Made for Prox Tool Steel throwaway bits or conventional ½" x 1". All chain parts made from alloy steels, heat treated for maximum physical performance, all block and connectors drop forged, bushings hardened and ground. Prox chains are made in many thicknesses to fit nearly every type of cutting machine and cutter bar. Get the best—get Prox!

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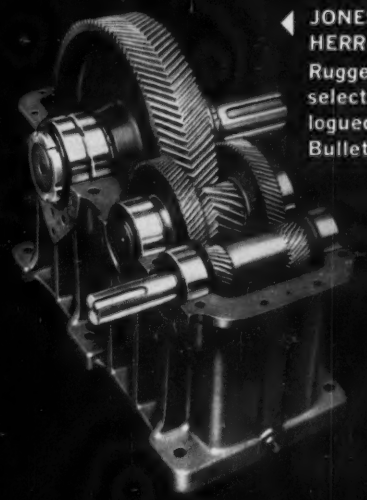

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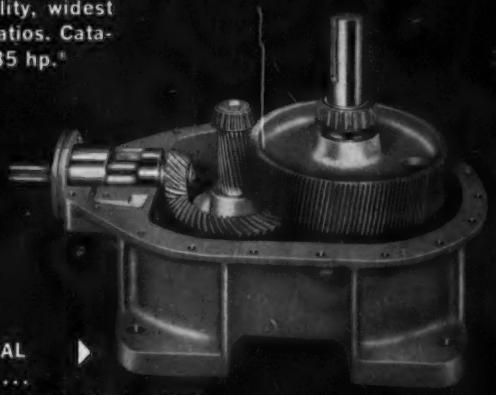
Ruggedness and reliability, widest selection of sizes and ratios. Catalogued capacities to 2,135 hp.* Bulletin J-26.



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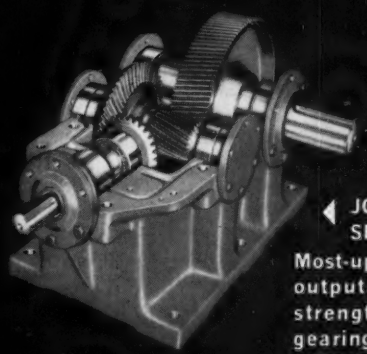
Newest in industry. Vertical output, right angle drive. High-strength spiral bevel and helical gearing. Catalogued capacities to 1,130 hp.* Bulletin J-25.



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Economical heavy duty service, vertical drive, medium to high speed reduction ratios. Catalogued capacities to 175 hp.* Bulletin J-14.

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JONES speed reducers: herringbone, **J-26;** *spiral bevel,* **J-25;** *worm helical,* **J-14;** *shaft-mounted,* **J-19;** *in-line helical,* **J-18;** *gearmotors,* **J-17;** *power transmission components,* **J-10A, J-16, J-23;** *complete drive units,* **J-11, J-22;** *UNION CHAIN: roller chain,* **RT-60;** *drive and conveying chain,* **A-4.**

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This modern track switch is thrown swiftly and safely by motormen as they sit in their cabs. It saves time and money, and is fool-proof and dependable!

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Save Trip Time on Main Haulage
Prevent Collisions

A two wire cable connects two or more signals together into one block. Only one signal can show proceed on the entrance of a trip, all other signals show stop.

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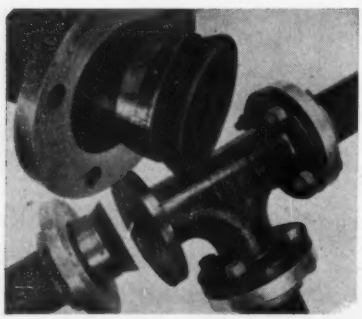
useful life. Ribbing also avoids corner rounding, providing a straight leading edge across the full width of the tip at all times. Caterpillar Tractor Co., Peoria, Ill.



PIPE FLANGES—Pipe joining with the reusable, free-flow Eveco flange is reported to reduce installation costs up to 80%. About 5 min is required to cut the pipe and another 5 min to join the pipes using the Eveco flange. No welding is required. Flanges need not be pre-fabricated to pipe since flange-hole alignment and squaring is automatic upon installation. And the flush, free-flow design eliminates sludge pockets and turbulence. Flanges are never in contact with corrosive liquids, making possible their substitution for more expensive noncorrosive flanges. All sizes are available. Stamperhanger Co., 1634 Telegraph Ave., Oakland 12, Calif.

Equipment Shorts

Transmission — A new heavy-duty Torqmatic transmission for high-production motorized equipment in the 200-300-hp range will soon be on the market. Designated the Model CLBT-4460, it is designed to handle 700 net ft lb of engine torque at engine speeds up to 2,500 rpm. Allison Div., General Motors Corp., Indianapolis, Ind.

Conveyors—A natural-frequency vibrating conveyor with a variable-stroke positive drive has been announced. Inclusion of the variable-stroke feature provides for the first time infinitely-variable conveying speeds from zero to maximum. Another feature is dynamic balancing whereby energy generated in the low-amplitude vibrating coil springs is reclaimed and used to help maintain conveyor action. Stephens-Adamson Mfg. Co., Aurora, Ill.

Safety Hat—The "Dura-Guard" line of hard hats and caps features all-plastic construction with no metal parts. Made in one headband model with a wide-fitting range, these lightweight products have permanent fixed and adjustable safety suspension. American Optical Co., Southbridge, Mass.

Enclosed Low-Hp Motors—A tube-type, totally-enclosed, fan-cooled motor, in lower horsepowers than previously available, has been designed for operation in contaminated atmospheres. Sizes range from 300 hp and up at 1,800 rpm. General Electric Co., Schenectady 5, N. Y.

Telescope—In addition to the internationally standard inverted image T-16 Optical Transit, Wild has made available the T-16E with Erecting Image Telescope for those wishing to work with upright images. Wild Heerbrugg Instruments, Inc., Main & Covert Sts., Port Washington, L. I., N. Y.

Magnetic Drum Separators — Record new volume capabilities are said to be possible with a redesigned and expanded line of permanent-magnetic drum separators for eliminating tramp-iron contamination. The largest drums, 30 to 36 in in diameter, remove particles at flow rate to 25,600 cu ft per hr. Eriez Mfg. Co., Erie 6, Pa.

Roof Bit and Drill Steel—The FVH roof bit and drill steel combination is said to provide maximum dust removal without loss of drilling speed. The ½-in square chuck has an integral collar that traps the dust in the slotted section through which the dust is drawn into the hollow drill steel. Kennametal Inc., Mining Tool Div., Bedford, Pa.

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- Including Gieseler Plastometer Test, sole heated oven test, moisture, ash, volatile and carbon determinations.

TEST INSTRUMENTS AND EQUIPMENT

- Automatic Gieseler Plastometer • Sole-heated Test Oven • Drop-Shatter Test Machine • Tumbler Test Machine • Cupola Bed Lighter

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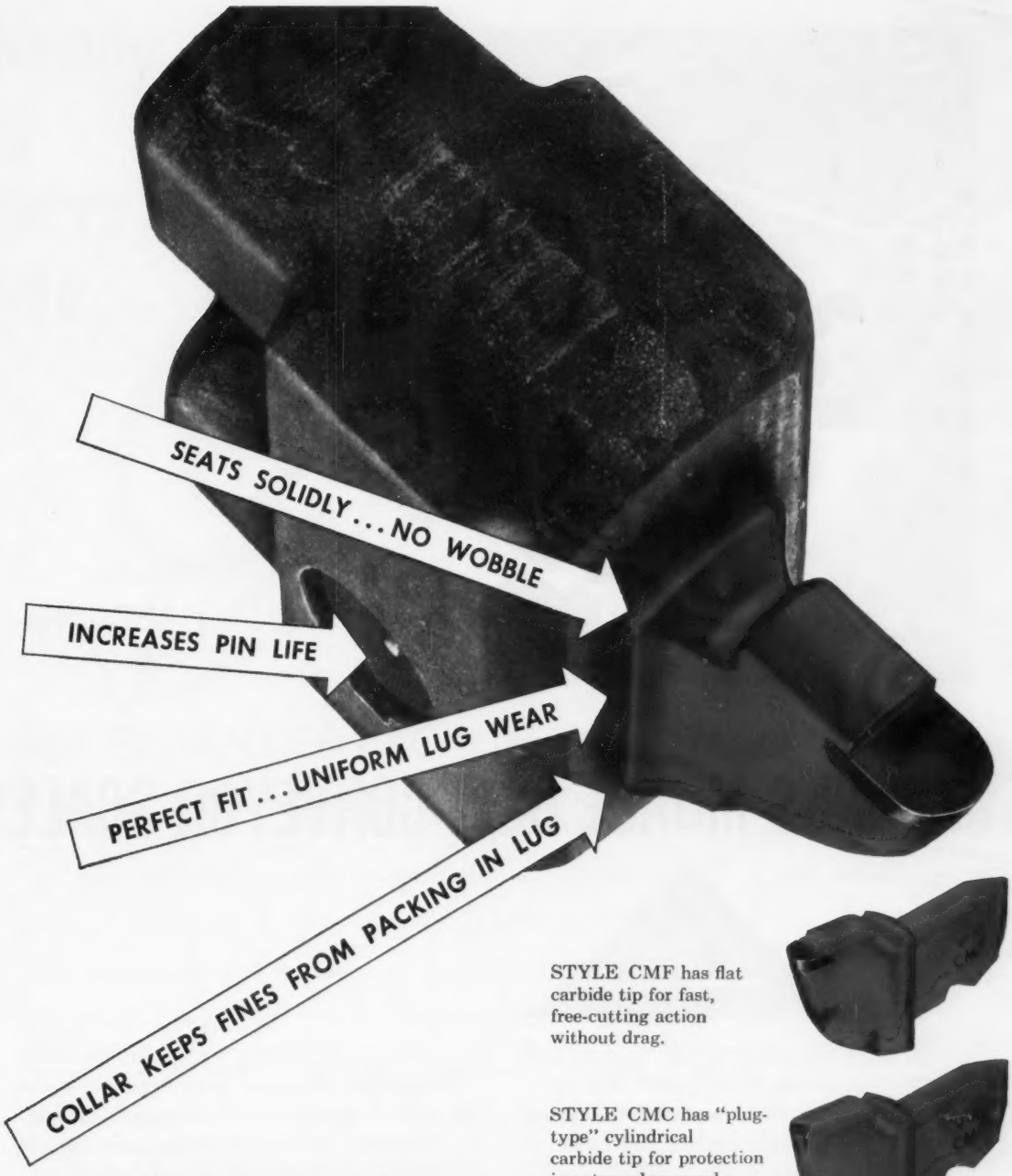
Explosive—Trojan primers contain cast pentolite, an extremely dense explosive that is entirely impervious to water.



STYLE CMF has flat carbide tip for fast, free-cutting action without drag.

STYLE CMC has "plug-type" cylindrical carbide tip for protection in extremely rugged cutting conditions.

WOBBLE-FREE RED BITS

with uniform lug wear

V-R Red Bits, have carbide tips manufactured especially for mining by V-R. Call your representative today and put these "wobble-free" V-R Red Bits to work on your equipment.

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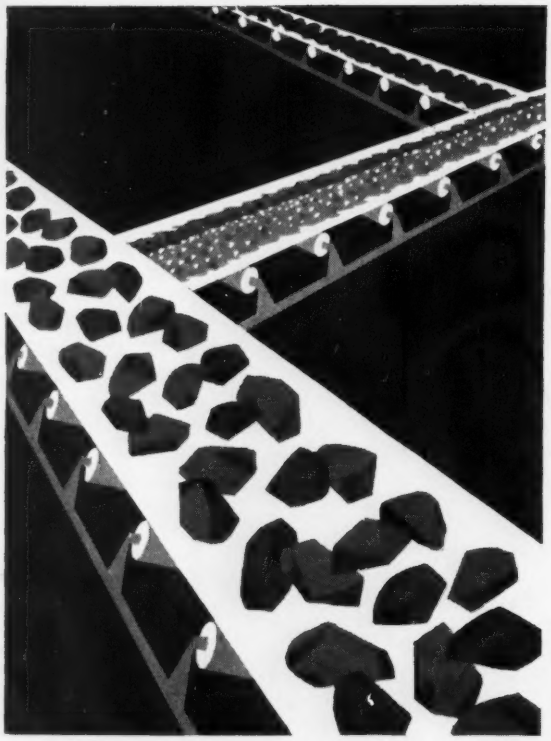
M-841



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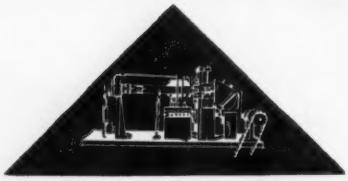
FAIRBANKS-MORSE BELT CONVEYOR SCALES



Now ore, minerals, concentrates, sludges and other materials can be quickly, easily and accurately weighed while they are passing by on conveyor belts. F-M specially designs belt conveyor scales for your specific needs ... assuring accuracy and economy for your particular operation.

With F-M Belt Conveyor Scales you get simple and positive operation that automatically totals the weight of the materials carried by the conveyor. The accumulated weight is shown on the direct-reading register ... there's no need to apply multipliers or conversion factors, and a means to provide a printed weight record is available.

The F-M Belt Conveyor Scale is simple in design and construction. The beam and integrating mechanism are housed in a dust-proof cabinet ... stainless steel and bronze parts mean minimum maintenance ... aid in the over-all accuracy of the scale.

To learn how F-M Belt Conveyor Scales can save money for your operation, write: **Dept. S-1; Scale Division; Fairbanks, Morse & Co., 100 Electra Lane, East Station; Yonkers, New York.**

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with EXPANDED FACILITIES to meet the demands of the coal industry...

Now Galis, and affiliates Fairmont Machinery and Lecco Screens offer services ranging from complete preparation plants through to the rewinding of a motor. "One stop shopping" gives the advantages of speedy combined engineering services, greatly reduced selling costs, co-ordinated shop fabrication procedure. What would you like in a hurry? Turn-key coal preparation plant—overhaul your present plant with newest type conveyor equipment—30 H.P. D.C. permissible Galis motors —Chance sand flotation coal washing and Lecco screens to upgrade product. Expert steel fabricating, chutes, hoppers, trusses.

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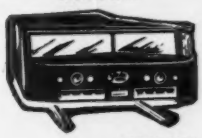
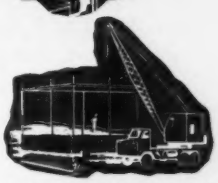


PORTAL CARS

UTILITY CARS

LECCO SCREENS

REBUILDING



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proved performance since 1908...

...on closed-circuit grinding, washing, desliming, dewatering, and size separation.

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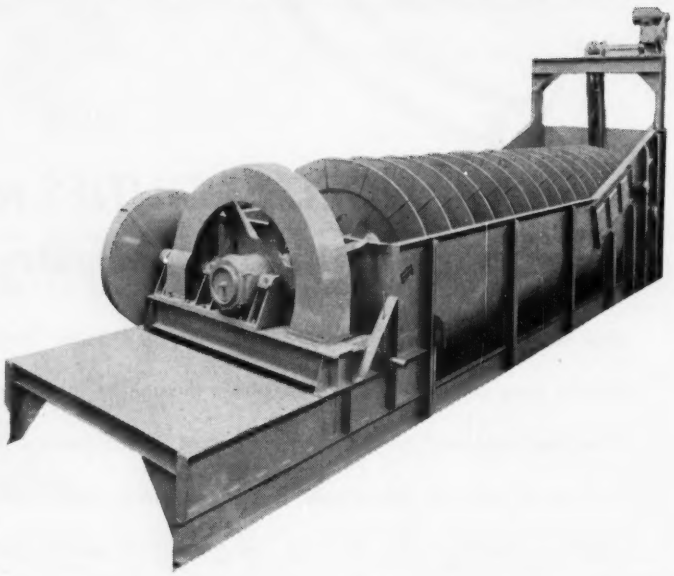
is the key to the outstanding performance of Akins Classifiers. During the past 52 years we have originated and field tested many ideas for improving both the mechanical and metallurgical performance of the Akins Classifier. From this experience, those ideas which have been field-proven to be advantageous are incorporated in the present Akins... the most effective spiral pitch, a trouble-free submerged bearing, best type of tank support, and adaptations, such as side weir, spray water box, serrated wearing shoes, and flared tank, for special applications.



Types: standard and submerged spiral; flared tank units for extra large pool; simplex and duplex.

Sizes: 12" to 84" spiral diameter.

Capacities: sand raking: up to 7860 tons for 24 hours; overflow: up to 2386 tons per 24 hours

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Licensed Manufacturers and Sales Agents in Canada, Australia, Sweden, England, South Africa. Sales Agents in Mexico, Peru, Chile, Philippine Islands, Japan, New York City (for Continental Europe) and in principal cities of the United States.

Though this solid explosive is more powerful than any type nitroglycerine gelatin made, it has the same safety characteristics as Trojan standard explosives. Covered in Form 103. Trojan Powder Co., 17 N. 7th St., Allentown, Pa.

Tips, Teeth, Shanks—Form DE117 describes new tips, teeth and shanks on Caterpillar Rippers as well as dozer, scraper and loader cutting edges improvements. Caterpillar Tractor Co., Peoria, Ill.

Centrifugal Pumps — You will find Aurora's complete line of single-stage, double-suction, horizontal split-case pumps illustrated and described in Bulletin 105C. Aurora Pump Div., New York Air Brake Co., Aurora, Ill.

Face Lubrication—A 4-p brochure tells "How You Can Simplify Face Lubrication" with only two products—a general purpose, semi-fluid lubricant and a hydraulic fluid. A device called the "gun-pump," designed for use both as a grease gun and as a lubricant pump, is also described in the booklet. Industrial Products Dept., Sun Oil Co., 1600 Walnut St., Philadelphia 3, Pa.

Two-Way Radios—Tubed and transistorized VHF two-way radios in power ratings of 100 w and less are featured in "Two-Way Mobile Radio," No. ECR-904. Section P, General Electric Communications Products Dept., P. O. Box 4197, Lynchburg, Va.

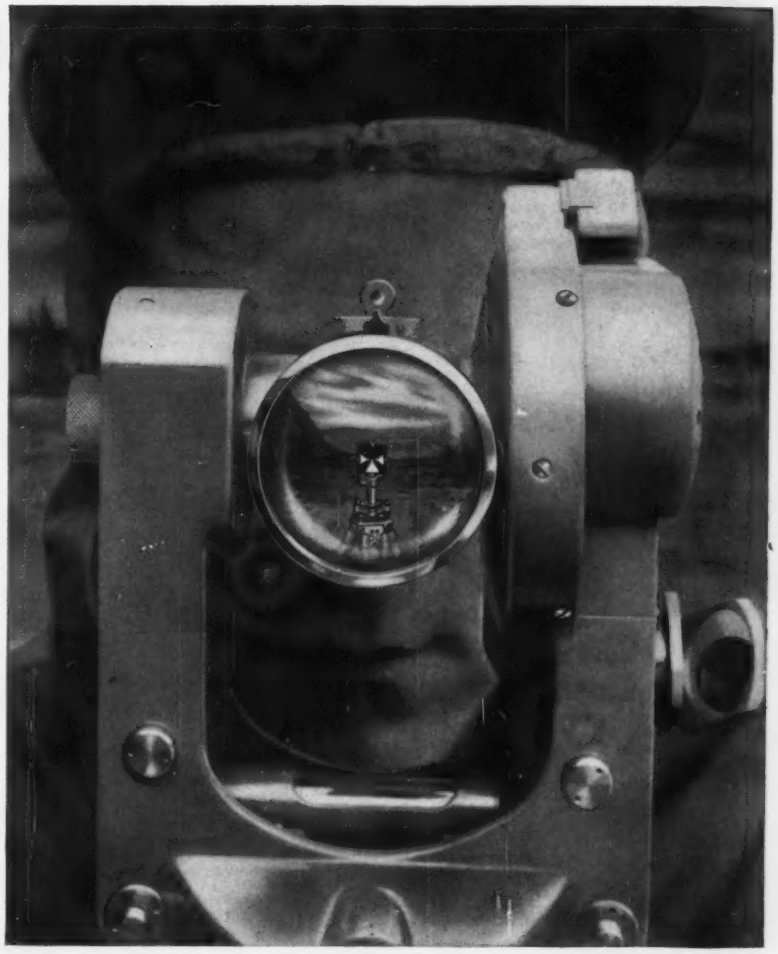
Heat Treatment — "Spin/Hard" heat treatment of sprockets, gears, traction wheels, rollers and other products requiring hardened areas for high wear resistance is the subject of Folder 2922. Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.

Track Parts and Rollers—"Users Report Big Savings" includes six reports from machine owners on how they have used and profited from large-size optional track parts and lifetime-lubricated rollers for their older D9 and D8 tractors. Caterpillar Tractor Co., Peoria, Ill.

Gear Drives—Featuring a simplified selection procedure, a new engineering catalog covers the company's line of heavy-duty enclosed helical-gear drives. Foote Bros. Gear & Machine Corp., 4545 S. Western Blvd., Chicago 9, Ill.

Froth Flotation—Brochure 861 describes the new Cyclo-Cell for froth flotation, the outstanding featue of which is the unequaled simplicity of design achieved by eliminating all moving parts. Heyl & Patterson, Inc., 55 Fort Pitt Blvd., Pittsburgh 22, Pa.

Tractor Shovel—Write for your copy of a specification bulletin explaining the



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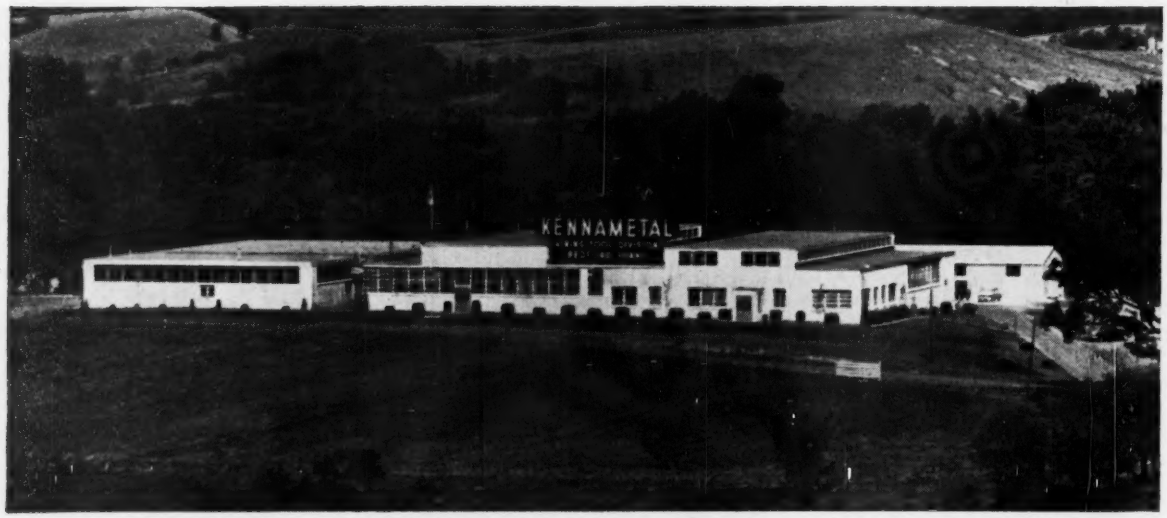
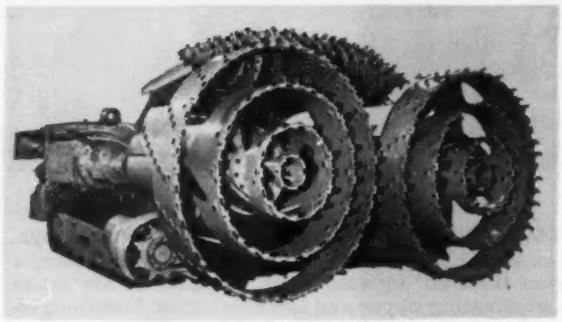


Modern plant at Bedford, Pennsylvania, is the operating center of the Kennametal Mining Tool Division — for research, design, development, production, and sales activities.



First Kennametal carbide bit developed for coal mining is shown above. The new Joy-Compton twin drum circular boring continuous miner (at left) illustrates an advanced application of carbide tools to a modern mining machine.

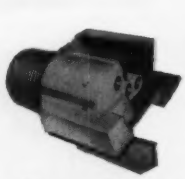
Kennametal carbide tooling helped pioneer modern mechanized mining

When wartime fuel requirements called for "crash program" coal production in 1941, Kennametal had already started development of carbide mining tools.

Bit shanks, fashioned from bar stock, were tipped with Kennametal tungsten carbide. Kennametal engineers began testing these carbide tools on mining machines in major bituminous coal mining areas. The results revolutionized coal cutting production rates and advanced the development of today's powerful continuous mining machines.

Kennametal has developed many firsts in the field of carbide mining tools — such as a series of tungsten carbide grades exclusively for mining tools, and specially designed forgings for both cutter bits and drill bits. Kennametal was also first to use aircraft-quality tubing for augers, and to develop a complete line of carbide tools for the coal mining industry. This line includes cutter bits — drill bits — roof bits — drag bits — augers — drill steels — and hardfacing materials.

For 20 years, Kennametal engineers have worked with mine operators and equipment manufacturers — designing carbide tools to help make coal mining safer, more efficient, and more economical. Several new Kennametal developments are shown below.



Kennametal Drag Bit

Style VAN Dust Collecting Bit Chuck

Style FVH Roof Bit

coal mining costs
top-quality tools • experienced service

Kennametal Representative and Mine Foreman study ways to cut costs at mine face

Kennametal Representatives provide practical service—based on 20 to 47 years of practical experience as mine supervisors and field service engineers. Each is a specialist in solving carbide tooling problems.

Your Kennametal man will work with your mine personnel to determine the nature of your cutting or drilling problem—and then recommend the right carbide bit for conditions in your mine.

On request, he will (1) conduct, or assist in conducting, tests to evaluate performance in actual operation and (2) help you get top bit performance at lowest possible bit cost, through correct usage and reconditioning of Kennametal carbide mining tools.

To check on how the superior performance of Kennametal bits may help improve production and profits at your mine, call your Kennametal Representative or contact us direct. KENNAMETAL INC., Mining Tool Division, Bedford, Pennsylvania. Phone 623-5134.

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For a large coal company in Southern West Virginia, three 40-ft. I.D. slip-form silos, 83 ft. high

ECONOMY . . . Initial cost competitive with other types of construction.

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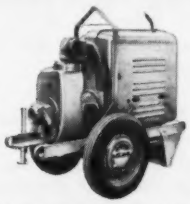
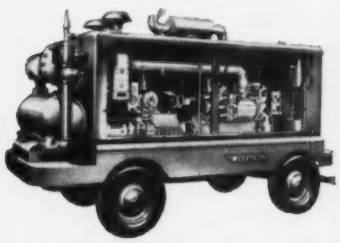
HOW JAEGER EQUIPMENT CUTS MINING COSTS



JAEGER SURE PRIME PUMPS give you four features you won't find in ordinary pumps: A bigger shell and impeller. Largest horsepower applicable. A positively lubricated shaft seal. And two independent, simultaneous priming actions. As a result you get faster, surer priming. Bigger capacity at much slower operating speed. And the longest pump and engine life.



JAEGER ROTO AIR PLUS COMPRESSORS deliver steady, full air pressure at slower engine speeds. For example, the Jaeger "600" (above) maintains full capacity at 1700 rpm. That's 100 rpm slower than competitive compressors using the exact same engine! Small wonder they last longer. Save on fuel and maintenance. Jaeger rotaries — 75 to 900 cfm — are comparably efficient.

Ask your Jaeger distributor for all the details — or write us for our new pump and compressor catalogs.

A MOUNTAIN OF WATER GOES UP THE HILL: These two Jaeger 6" diesel powered pumps had been pumping 24 hrs. a day, 9 months a year for 3 years on a Pennsylvania strip mine operation when the picture was taken.

THE JAEGER MACHINE COMPANY, 673 Dublin Avenue, Columbus 16, Ohio

Jaeger Machine Company of Canada, Ltd., St. Thomas, Ontario

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custom built
MINING STARTERS

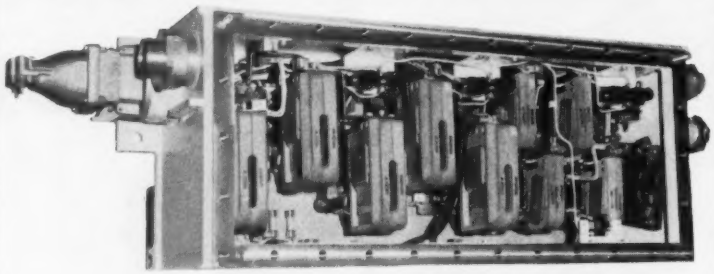

Photo illustrates ENSIGN Bulletin 5391 Magnetic Reduced Voltage Starter, 240 Volts DC. Multi-motor control for 50 HP, 15 HP, and 7½ HP motors in Bureau of Mines explosion-tested enclosure custom built for Wilcox Miner.

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OUR ENGINEERING AND PRODUCTION TEAM ARE SPECIALISTS IN BUILDING CONTROL EQUIPMENT ACCORDING TO SPECIFICATIONS OF THE U. S. BUREAU OF MINES.

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WE ARE PROUD OF OUR FULL LINE OF STANDARD AC AND DC STARTERS
WE WELCOME INQUIRIES ON ALL STARTERS
STANDARD OR CUSTOM BUILT TO YOUR REQUIREMENTS

ENSIGN
ELECTRIC AND MANUFACTURING COMPANY
914 Adams Avenue Huntington, West Virginia

features of the improved Model 404 Trojan tractor shovel with two diesel-engine options. Yale & Towne Mfg. Co., Trojan Div., Batavia, N. Y.

Speed Changers—Design features of the Vari-Tex speed changer that provides dependable low-cost variable speed are covered in Bulletins 51B9061B and 51B-1042. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Materials Flow Control—A comprehensive bulletin has been published on feeding, weighing, blending and proportioning equipment for the controlled feeding of liquids and solids in process industries. B-I-F Industries, P. O. Box 276, Providence 1, R. I.

Steel Welding—"How to Weld 'T-1' Steel" is a 16-mm color-and-sound motion picture produced especially for training purposes. A comprehensive booklet will be presented to everyone who views the 18-min film. U. S. Steel Corp., Rm 6363, 525 William Penn Pl., Pittsburgh 30, Pa.

Direct-Mounted Motors—How the direct-mounted motor on the Low-Head screen saves headroom, reduces belt cost and wear and simplifies maintenance is revealed in "The Motor Rides Piggyback," Bulletin 26B9996. Allis-Chalmers Mfg. Co., Industrial Equipment Div., Milwaukee 1, Wis.

Flotation—The 31st annual edition of the Flotation Index, a bibliography of 517 articles which have appeared in leading mining publications, is now available. The new edition covers information published in 1960 and is presented in a revised format for easier reference. Dow Chemical Co., Midland, Mich.

Welding and Hard Surfacing—"Handbook for Welding Low-Alloy High-Tensile Steels" is a 64-p reference on the use and advantages of these steels in the relining or construction of mining haul vehicles, ore cars, dragline or dipper buckets and chutes. Another 64-p catalog contains individual data sheets on the company's complete line of hard surfacing products. Alloy Rods Co., York, Pa.

Wound Rotor Motors—Designed to meet the requirements of any wound-rotor application, wound-rotor motors range in size from 1-30 hp. Bulletin 104 tells all. Dept. P, Louis Allis Co., 427 E. Stewart St., Milwaukee, Wis.

Pump Basics—A 16-p booklet entitled "Pump Fundamentals" gives the reader an elementary outline of the characteristics, operation and selection of reciprocating, rotary and, particularly, centrifugal pumps. Goulds Pumps, Inc., 226 Block Brook Rd., Seneca Falls, N. Y.

50 years and 75 years . . .

THE GOLD AND THE DIAMOND!

Heyl & Patterson, approaching its Diamond Jubilee, salutes a respected magazine and a distinguished Publishing House on the Golden Anniversary of Coal Age.

50 years ago, when Coal Age was launched on its illustrious career, H & P had already pioneered coal preparation equipment, notably the Bradford Coal Breaker. Through the years, we fixed our sights on developing reliable equipment to better serve the Coal Industry.

The result is that today's Heyl & Patterson Preparation Plants frequently include such recognized leaders as the . . .

- **H & P Fluid Bed Dryers**
- **H & P Cyclones**
- **H & P Sieve Bends**
- **H & P Cyclo-Cells for Froth Flotation**
- **H & P Heavy-Media Washing Equipment**
- **Reineveld Fine Coal Dryer**
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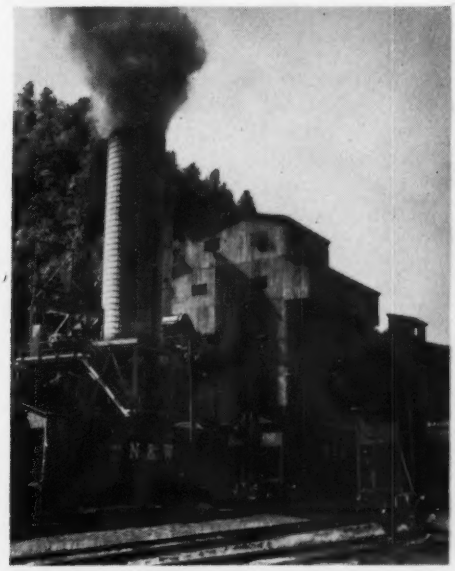
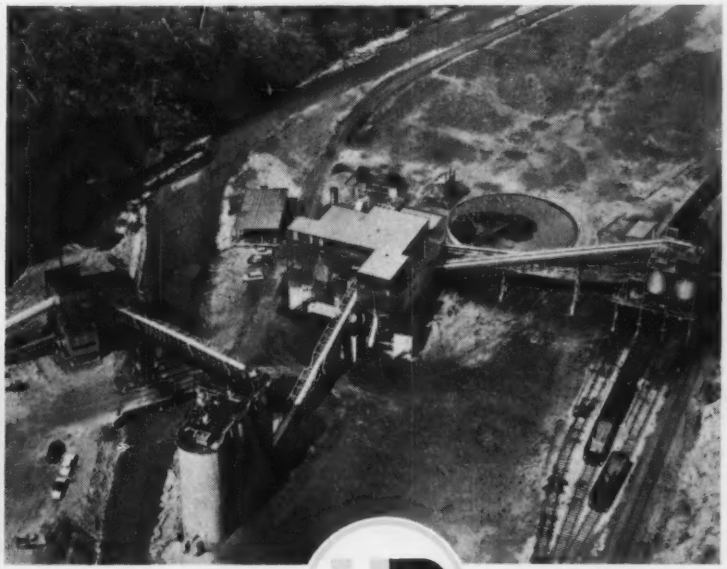
New ideas are being conceived and new designs developed by an engineering staff eager for Progress. Research and testing are carried on continuously in our Laboratory. Backing up these activities are modern production facilities and methods.

For teamwork and know-how, deal with Heyl & Patterson.

160 TPH Fine Coal Cleaning and Thermal Drying Plant—Maben, W. Va.



440 TPH Coarse and Fine Coal Cleaning and Thermal Drying Plant—Hampton #4, Clothier, W. Va.



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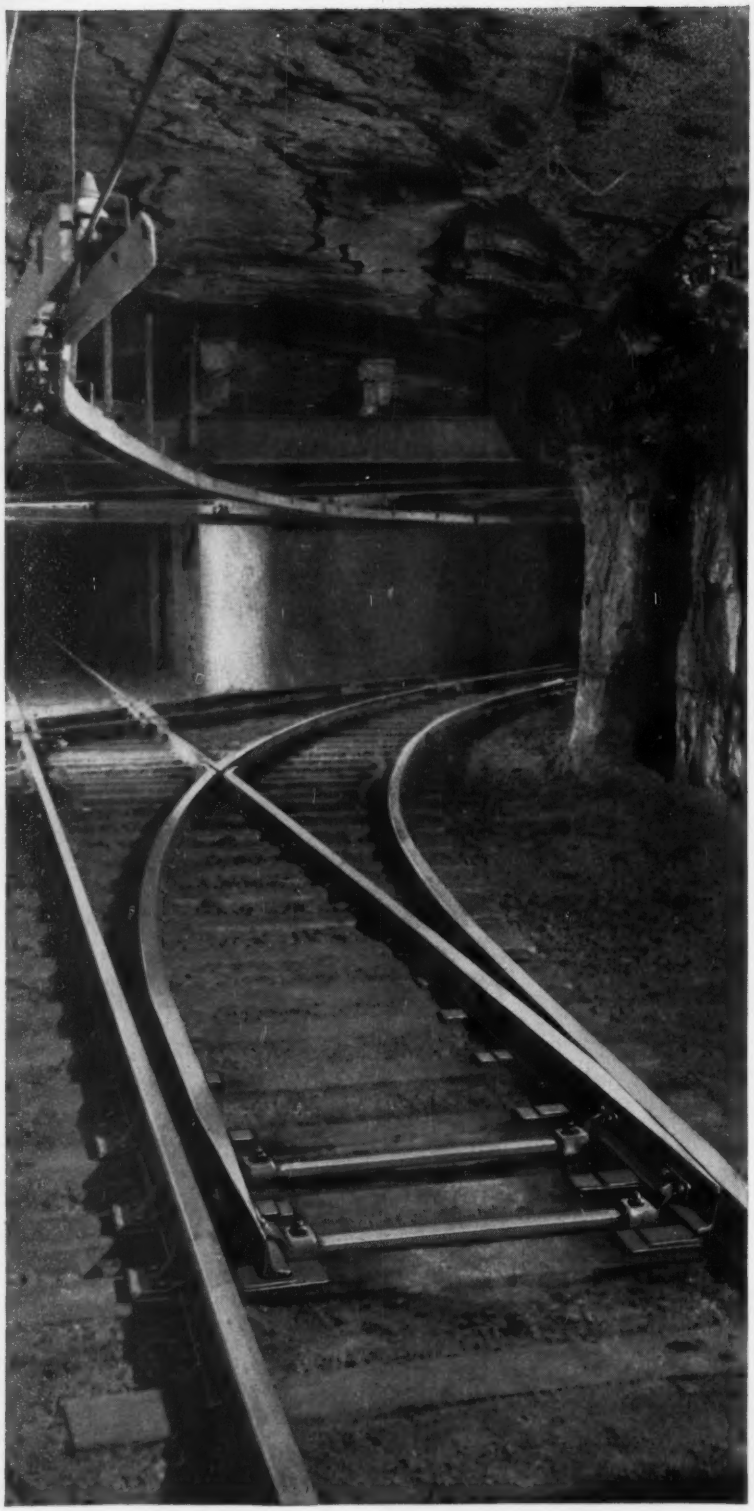
CHARLESTON DISTRICT OFFICE: 913 Brooks St., Charleston 29, W. Va. • TEL. 342-8805

Since 1887 . . . serving the Coal Industry



Have you a haulage system...

or just track?

If you feel your haulage system leaves something to be desired, we urge you to call in a Bethlehem engineer and let him study your plans. In this session he'll let you do most of the talking while he absorbs your problems, both present and anticipated.

Then he'll return to Bethlehem and go into a huddle with mine-track specialists here. Plans will be drawn up for your approval, after which all rail material will be prepared according to plan, including pre-cutting and curving to radius.

All important sections of track work will be completely assembled on our layout floors before shipment is made to you. When your order arrives at the job-site, all the waste and worry will have been ironed out of the project.

A Bethlehem prefabricated layout usually pays for itself in a hurry, through substantial operating economies. Like to talk it over? Just get in touch with our nearest sales office and we'll arrange a meeting.

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Steel *for strength ...economy ...versatility*

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1. NUTO® rust- and oxidation-inhibited hydraulic oil gives extended service. Provides outstanding protection against rust in hydraulic systems used in damp mine conditions. Excellent fluidity for fast start-ups at low temperatures. Maintains good body at high operating temperatures to minimize leakage and pump wear.

2. NEBULA® EP 5F a semi-fluid grease for lubricating gears, bearings, clutches and linkages. Provides extreme-pressure and anti-wear qualities. Inhibits oxidation over long service. Minimizes leakage through seals by virtue of its semi-fluid consistency, unchanged by heat or churning.

Your Esso representative can help you keep production humming with a full line of advanced fuels and lubricants. Contact him for more information, or write us at 15 West 51st Street, New York 19, New York.

HUMBLE OIL & REFINING COMPANY **Esso**

DOZING PACEMAKER IN HIGH GEAR

For stripping overburden, the Allis-Chalmers HD-21 with wide range transmission is in a class by itself. This tractor moves bigger loads over a wider speed range, than any other machine in its price range.

Ever stop to think about the difference just 1 or even ½ mph can make on long stripping operations, pioneering, road maintenance and cleanup work? For example, an Allis-Chalmers torque converter HD-21 averaging 3 mph dozes 60 miles every time a comparable-sized machine averaging 2.5 mph dozes 50.

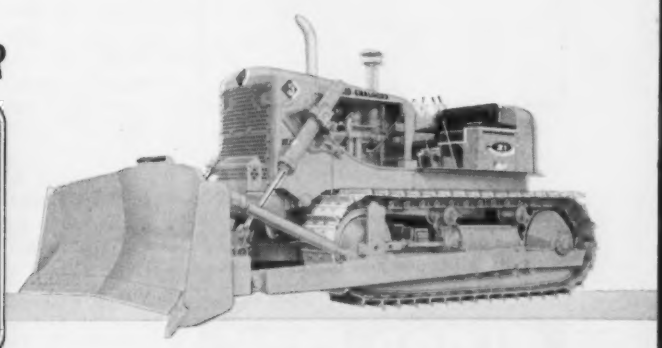
And you'll get this speed advantage with an HD-21 on jobs like those above that you can handle in this tractor's wide range high gear. It gives you a speed spread of 0 to 6 mph. Using only this gear, the operator can do more work in the 1.75 to 4.5 mph range than comparable units can do in three gear ranges. And for heavy dozing, the HD-21's low gear gives this tractor the big load power in the 1-to 2-mph range.

But it's more than just raw speed that makes the HD-21 a big-production dozer. It's stability with the long track that smooths out tractor bounce. It's fast acceleration with the best engine-torque converter combination in the industry. It's precise control with quickly responsive levers and a tight-fitting, close-coupled blade. At top mph, the HD-21 dozer can hold a level grade which "sloppy" dozers can't begin to match even at slow speeds. It's all these things that add up to low-cost dirt.

Your Allis-Chalmers dealer is confident that the HD-21 will give you more for your dozing dollar — not only with the workingest high gear, but also long-life oil steering clutches and brakes, the toughest track ever built . . . the industry's healthiest engine, certified permanent lubrication of truck wheels, unit construction for easiest maintenance. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

STEP UP YOUR

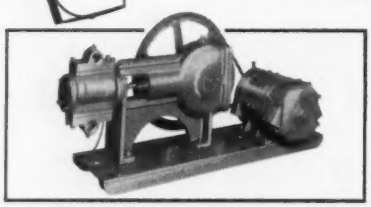
Performance
Operator comfort
Wearability
Ease of maintenance
Reliability



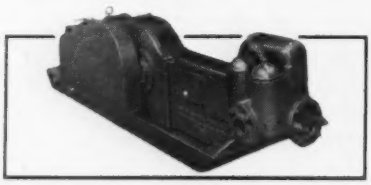
WITH **ALLIS-CHALMERS**
POWER FOR A GROWING WORLD

It's so simple—
when you need
a pump *Call*

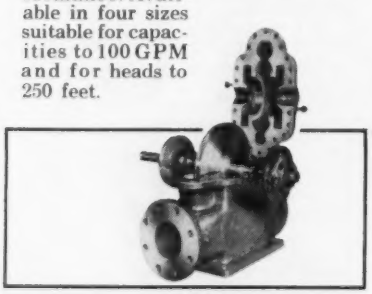
FLOOD CITY



Gathering Type PLUNGER PUMP—dependable, light, compact. Has many uses. Pipe connections are brought into proper position by reversing suction and discharge chambers. 42" long, 17" wide, 22" high, weight (less motor) 260 pounds.



Austin-Brownie Mine Gathering PUMP—single cylinder, double-acting piston type. Fully enclosed, oil bath lubricated working parts. Rugged construction for difficult pumping conditions, dependable performance. Available in four sizes suitable for capacities to 100 GPM and for heads to 250 feet.



CENTRIFUGAL PUMPS highly rated for complete reliability and service. All sizes to 8" discharge and 1500 GPM. In acid-resisting bronze or stainless steel.

PUMP REPLACEMENT PARTS for practically all types and makes of centrifugal and plunger pumps.

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Among the Manufacturers

Two new regional vice presidents elected by **General Electric** are **Charles J. Ellis** and **Harry P. Gough** for the southeastern and western regions respectively. Mr. Ellis succeeds **Carter L. Redd,** who until his retirement on Jan. 1, 1962, will be consultant to Mr. Ellis. And Mr. Gough succeeds **Clarence C. Walker,** who until his retirement Nov. 1, will be consultant to Mr. Gough.

Harry M. Horton has been appointed sales manager for **Link-Belt Co.'s** Philadelphia plant succeeding **James H. Oakes** who passed away recently after 33 yr with the company. And **Alfred B. Schachte Jr.** has been named assistant sales manager. Taking over Mr. Horton's former duties as district manager at Summit, N. J., is **John J. Bradley.**

M. Lloyd Jones Jr. will be moving to Cleveland shortly to take over his new responsibilities as reusable hose products sales manager, **Parker Fittings & Hose Div., Parker-Hannifin Corp.** He was formerly manager of distributor sales for Aeroquip Corp. and more recently manager of an Aeroquip west coast operation.

H. K. Porter Co., Inc. has named **James A. Thomson** branch manager of its National Electric Div. to succeed **John Longden** who resigned. Affiliated with the electrical industry since 1935, Mr. Thomson had been a salesman for Graybar Electric Co., Inc. for 16 yr.

R. L. Hanes has been elected vice president in charge of sales of **Colorado Fuel & Iron Corp.'s Western Div.** while **E. George Hartmann** will asume the same responsibilities for the firm's Wickwire Spencer Steel and John A. Roebling's Sons divisions. Associated with CF&I for 32 yr, Mr. Hanes had been serving as general manager of tubular sales since 1960 and had also held executive sales posts. Mr. Hartmann, who joined Roebling in 1940, had been vice president of sales of that division since 1958.

Succeeding **J. R. McBeth** who retired July 1, **Thomas F. Devine** has been made district manager of **Owatonna Tool Co.** His territory will include southern Ohio, eastern Kentucky and southwest Virginia.

Frank T. Dainese, who started the Charleston, W. Va., office of **Independent Explosives Co.** 15 yr ago, has been named vice president of the company. Under his leadership the Charleston f-fice grew from a one-man operation to an organization of salesmen, magazine keepers and truckers covering all of West Virginia and parts of six adjoining states.

Joy Mfg. Co. has announced promotions within its Coal Machinery Div. **R. R. Fenner** transferred from Franklin, Pa., where he had been manager of the Order Service Dept., to Carlsbad, N. M., with new duties of assistant district manager of the Denver, Colo., Coal Div. office. New chief engineer of conveyors at the Franklin plant is **Frank Muro** who had been chief engineer of the Rock Drill Dept. in Claremont, N. H.

Lyle T. Hanse, who joined **Link-Belt Speeder Corp.** in 1950, has been named assistant sales manager of the firm. He served 10 yr as a district representative for Link-Belt Speeder in three different sales teritories. Then, in 1960, he joined the Link-Belt Speeder distributor in Louisiana as a branch manager.

In his new post as general marketing manager, **Air Reduction Sales Co., G. L. Werly Jr.** will direct operations of the Equipment, Gas and Distributor marketing departments. Shortly after joining Airco's medical division in Madison, Wis., as a sales trainee in 1951, he became a salesman and, in 1954, was promoted to manager of gas sales of that division. He was later made a sales manager and, in 1959, was made manager of the Gas Marketing Department in New York City.

Russell B. Miller, a 25-yr **Chicago Pneumatic Tool Co.** veteran, has been appointed general sales manager with headquarters at the New York general offices. Initially employed at the firm's Franklin, Pa., manufacturing facility, Mr. Miller later transferred to the sales department at Birmingham, Ala. He was made assistant district manager of the Atlanta District in 1939 and manager in 1952.

Charles M. Anderson has been chosen general manager of **W. R. Stamler Corp.** succeding **Labron W. Miller** who resigned. Mr. Anderson has served Stamler in various capacities since 1953.

Colorado Fuel & Iron Corp. has promoted two sales executives. **Forest S. Burtch,** who joined the company in 1923, has been named general sales manager for the John A. Roebling's Sons Div. He had been general product manager for Roebling's Construction Materials Div. since 1953. And **Howard S. Christie** has been made assistant director of sales,

★ ★

Design, Engineering & Construction by ROBERTS & SCHAEFER

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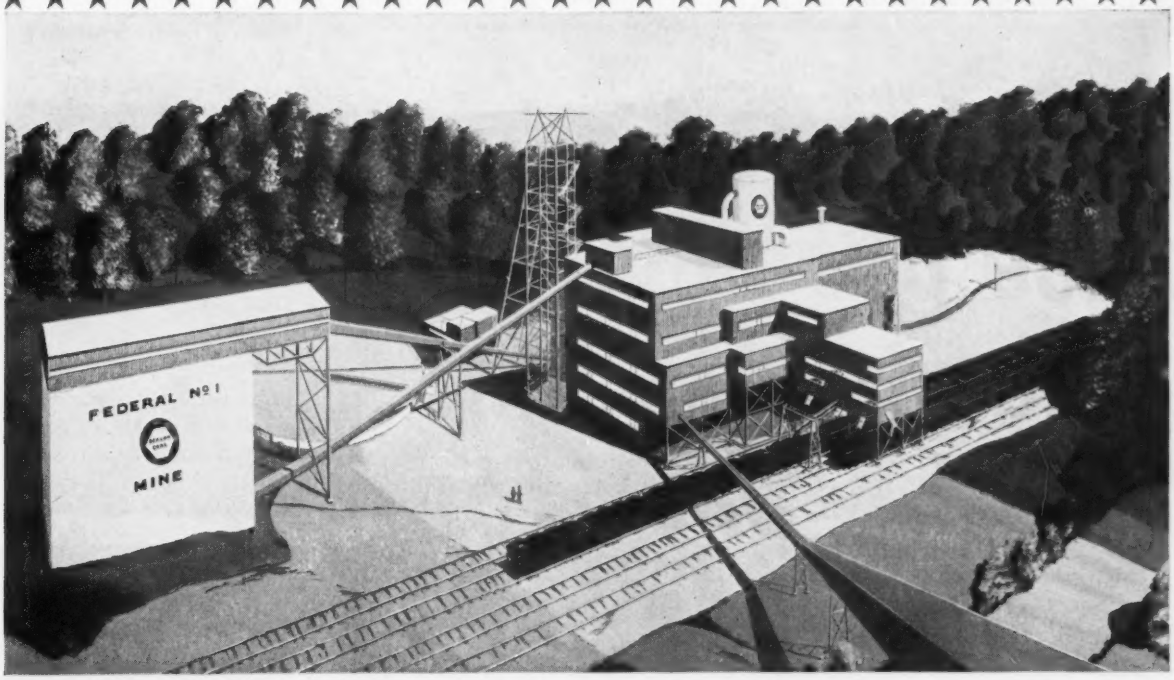

Artist's sketch of new cleaning plant, Federal No. 1 Mine, Grant Town, West Virginia

EASTERN GAS and FUEL ASSOCIATES

New Cleaning Plant, Federal No. 1 Mine

A new, improved, cleaner BEACON COAL will be on the market early in 1962 upon completion of Eastern's huge new processing plant at Federal Mine No. 1.

This new facility will be the most modern, highly automated plant in the Fairmont, West Virginia, coal field. It is designed to produce 12,500 tons-per-day of completely cleaned and dried coal in a wide range of sizes.

Symbolic of Eastern's faith in the future of coal, the new plant will meet the continually expanding demand for quality coals for public utility, industrial and domestic use.

ENGINEERS & CONTRACTORS

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ROBERTS & SCHAEFER Company

DIVISION OF THOMPSON-STARRETT COMPANY, INC.

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NEW YORK 19, N.Y. • PITTSBURGH 22, PA. • HUNTINGTON 10, W. VA. • ST. PAUL 1, MINN.

Long-Airdox face preparation team sets fast pace for high-capacity mining systems

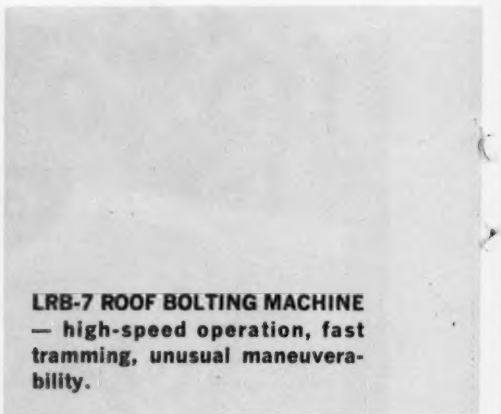
Here is how to have faster face preparation and higher production with lower costs—regardless of seam height. Take advantage of the superior speed and flexibility of this unique Long-Airdox face preparation team . . .

LRB-7 ROOF BOLTER. The most versatile and powerful machine of its type. Offers highest torque and thrust; most effective internal, through-steel dust collector; fast easy operation; low-maintenance hydraulic system.

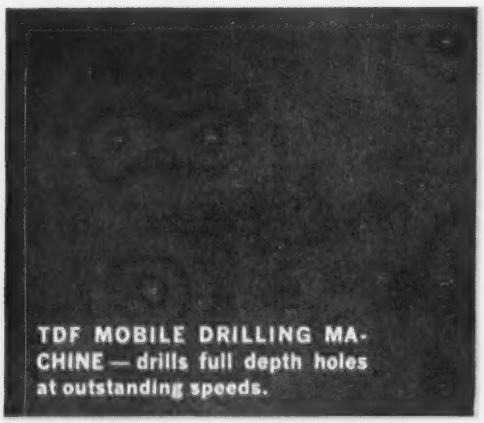
TDF DRILLING-SHOOTING MACHINE. Makes it possible for one man to handle both drilling and shooting in comparable time with either cutting or loading. "Rotary-Thrust" drilling principle applies thrust closer to face than any competitive machine. Three models for all seam heights and conditions.

AUTOMATIC AIRDOX SHOOTING. Faster than any other system and gives better product. Lighter weight automatic discharge tubes; sequence shooting of any number of holes in a single operation; and single-unit TDF drilling, multiple-shooting machine (which transports tubes and sequence valves) now make this system practical and economical for all conventional mining.

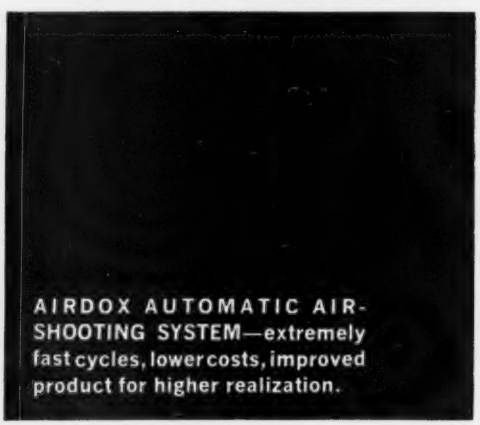
For facts and figures, write Long-Airdox, Oak Hill, West Virginia.



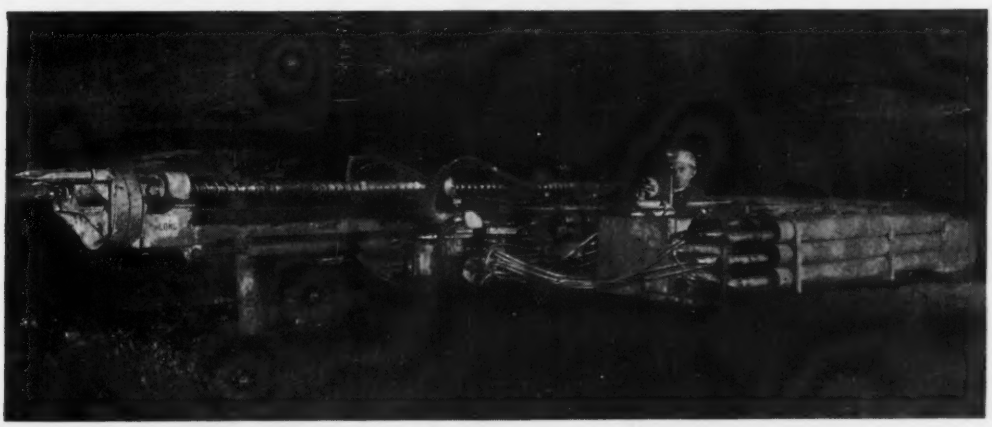
LRB-7 ROOF BOLTING MACHINE — high-speed operation, fast tramming, unusual maneuverability.



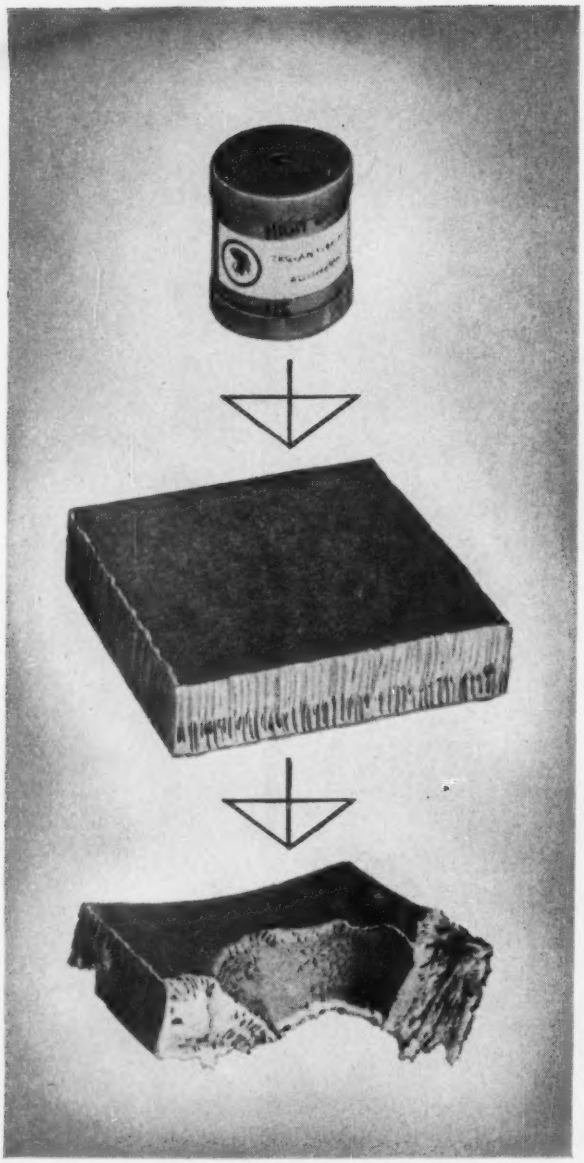
TDF MOBILE DRILLING MACHINE — drills full depth holes at outstanding speeds.



AIRDOX AUTOMATIC AIR-SHOOTING SYSTEM—extremely fast cycles, lower costs, improved product for higher realization.



LONG-AIRDOX



This is what happened to a 6" x 6" x 1" steel plate when a No. 4 (½ lb.) Trojan Primer was placed on it and detonated.

Those who think all primers are alike have never used

TROJAN PENTOLITE PRIMERS

- Dependable—Safe—Economical
- Impervious to Water
- Contains no nitroglycerin to produce "dynamite" headaches
- Thousands used since 1949
- For detonating insensitive blasting agents

New bulletin #103 upon request

5
POWER-PACKED SIZES

TROJAN POWDER COMPANY

Originators of first successful non-headache dynamite

Seventeen North 7th St., Allentown, Penna.
Plants: Allentown, Pa. · Wolf Lake, Ill. · San Leandro, Calif.
Sales offices and distributing magazines in principal consumer districts.

TROJAN® Explosives

HIGH EXPLOSIVES • BLASTING AGENTS • SEISMIC EXPLOSIVES • PERMISSIBLES • CUSTOM-DEVELOPED EXPLOSIVES TO MEET SPECIAL REQUIREMENTS • BLASTING SUPPLIES

national accounts, for CF&I. An employee since 1945, Mr. Christie had been serving as Detroit district manager, handling wire and cold rolled-steel products since 1951.

Harold B. Ewoldt has joined **LeTourneau-Westinghouse Co.** as truck specialist, sales. His 30 yr experience in construction and mining includes a post as district engineer for the U. S. Bureau of Mines, after which he moved on to staff and management positions with other mining organizations.

Myron R. Coughenour has been appointed sales engineer for **Connellsville Corp.,** Connellsville, Pa. Having begun his career in the 1920's as a draftsman for the company, he later joined Consolidation Coal Co. as an estimator in the construction department and has since spent over 30 yr with Fairmont Machinery Co.

Coleman Cable & Wire Co., River Grove, Ill., has brought into its organization **Arthur F. Hebberger** and **Frank J. Gallagher** to act as sales engineers on the company's new line of plastic mining-machine cable. Mr. Hebberger had been with Joy Mfg. Co.'s Electrical Div. while Mr. Gallagher had been employed by the U.S. Bureau of Mines.

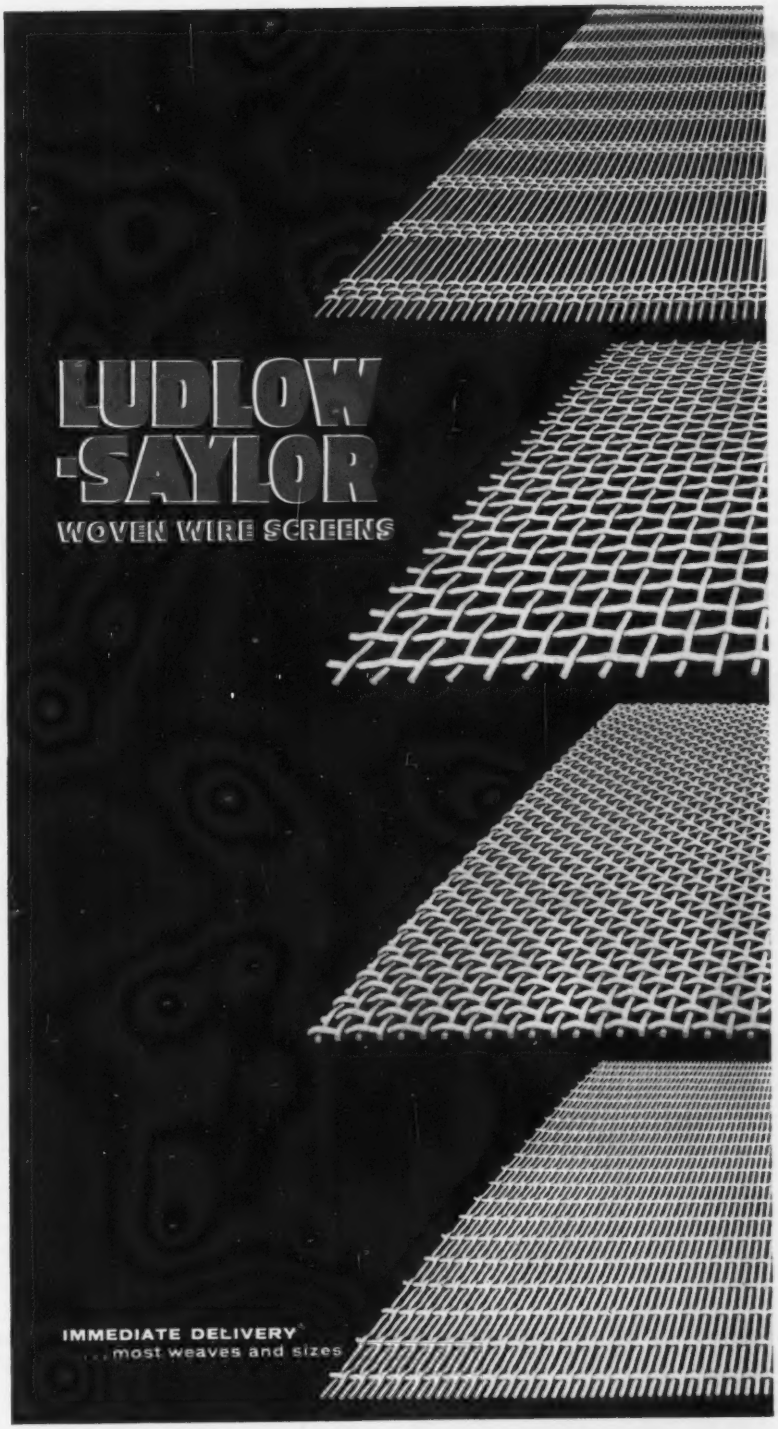
Gene L. Bego has been named general sales manager of **B. F. Goodrich Industrial Products Co., a division of the B. F. Goodrich Co.,** Akron, Ohio. His assignment is a newly-created position with responsibility for sales of a variety of industrial products including conveyor belting, hose, molded and extruded rubber and plastic products.

Obituary

L. C. (Mose) Mosley, manager, mining division, **Marion Power Shovel Co.** since 1946, died Aug. 28 in Cleveland following heart surgery. He had been associated with Marion for 36 yr, having joined as an application engineer in 1925. In that capacity Mr. Mosley studied mines all over the U.S. and Canada, and developed mining plans for many foreign countries.

A. F. Busick Jr., Marions' president and general manager, said, "Mr. Mosley's knowledge, ability, integrity and warm personality made an incalculable contribution to the success of this company. . ."

(*Continued on p 316*)



Tops in Durability!

The hardest, toughest wire available, tightly, accurately woven to deliver ultimate resistance to abrasion, fatigue and distortion.

L-S Screens and Wire Cloth can be furnished in any steel including high carbon, oil-tempered, stainless or other alloy; in Monel, bronze, copper, brass and most other metals that can be drawn

Founded in 1856 105 years

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STAR WIRE SCREEN & IRON WORKS, INC. (L-S Subsidiary)
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He's increasing tonnage, cutting costs, saving time! His Sunoco 740-A EP lubricant is teamed with just *one* Sunoco hydraulic oil (job-fitted from a full line of hydraulic oils) to meet all daily lube needs at the face! Sunoco 740-A EP clings like grease, pours like oil. It fights rust, oxidation, has extra film strength to stand up under coal dust. It's more adhesive, too, with better load-carrying capacities. Pioneering of the basic two-product *quality* lube program by Sunoco even sparked development, in conjunction with a leading equipment manufacturer, of the well-known two-output pump shown above. It can be used with a product like 740-A EP to fill gear cases at high *volume* or on pressure fittings at high *pressure*.

What's the difference in 2-product lube programs?

SUNOCO

QUALITY. . .

THE BEST ECONOMY OF ALL

Simply this: with the Sunoco program you are assured the product quality it takes to meet all your daily needs at the face . . . *job-fitted* by men who developed the simplified lube program . . . backed by the service you have a right to expect . . . Call your Sun representative today and get squared away on real savings. Or write to: Sun Oil Company, Philadelphia 3, Pa., Dept. CA-10. In Canada: Sun Oil Company Limited, Toronto and Montreal.

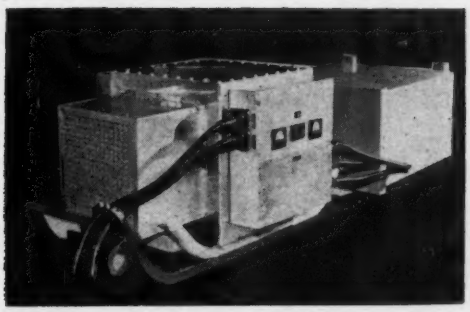
PIONEERING PETROLEUM PROGRESS FOR 75 YEARS

TO INSURE SUCCESSFUL PERFORMANCE

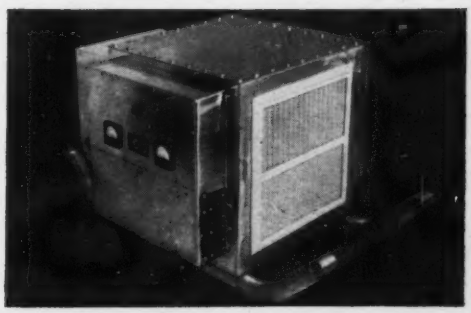
SELECT A SILPAK UNIT

POWER RECTIFIER

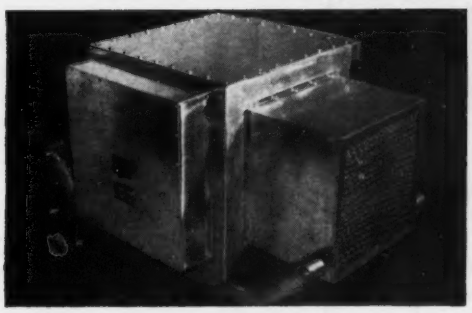
TO FIT YOUR NEEDS...



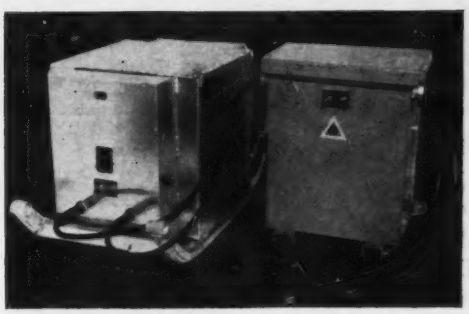
3-phase 150-KW



3-phase 100-KW



3-phase 75-KW



1-phase 50-KW

THE SILPAK 3150, a 150-KW 3-phase air-cooled unit, is now available along with the 3-phase Models 3100, 375, 360 for capacities of 100 KW, 75 KW, and 60 KW, respectively. These are ideal DC power supplies for small mines operating near 3-phase distribution lines. Silpak for greater or smaller capacity can be fabricated.

For mines not near a 3-phase power line, Pemco manufactures a 50-KW single-phase unit with a specially designed transformer. This unit has already won high acclaim among small truck mine operators in Kentucky, Virginia, and West Virginia.

Descriptive literature on the above models will be mailed on request.

Silpak units for industrial and chemical processes can be engineered and fabricated for special application.

SILPAK

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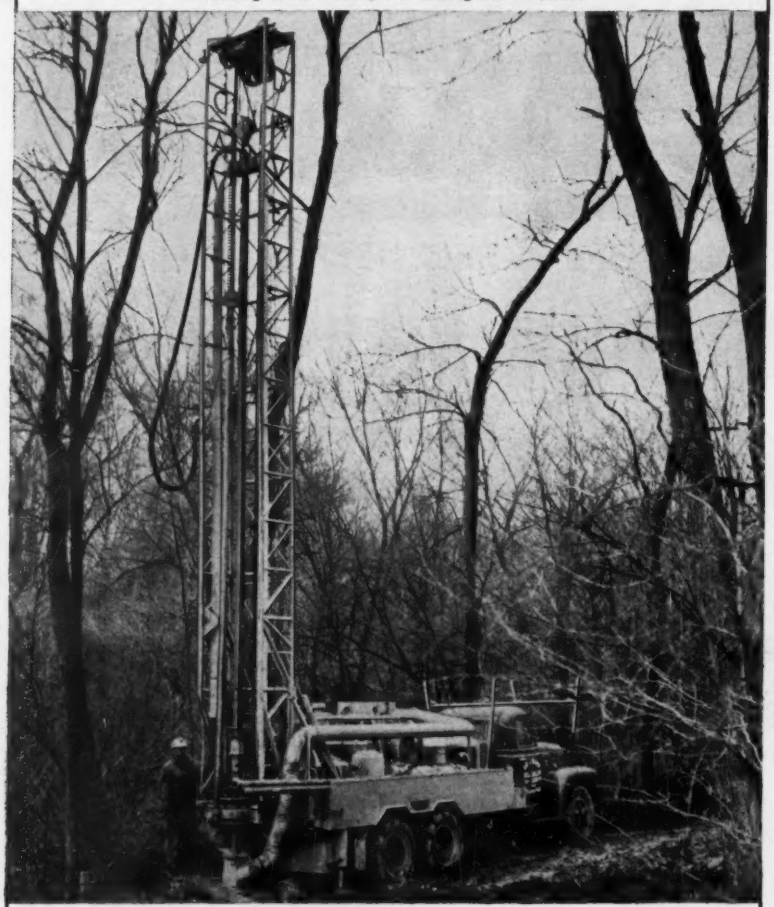
PEMCO CORP.

BOX 1256 • BLUEFIELD, W. VA.

Phone: DA-76140

Davey Model M-75A Rotary Drill coal testing for Harbaugh Coal Co., Madison, Pa. Working in the woods, it is drilling 300 ft. holes.



a modern drill for modern mining

Breaks Production Traffic Jams

Davey Rotary Drills are faster in and out of blast holes . . . move rapidly between holes. They cut blasting costs . . . increase effectiveness of blasts . . . speed overburden removal.

. . . these are just a few of many reasons why more and more leading mine operators and coal drilling contractors are standardizing on Davey.

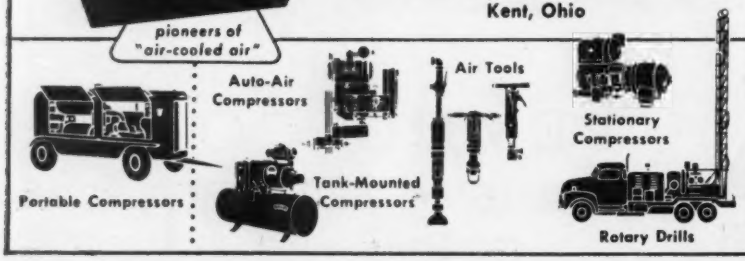
Available in 8 air blast, mud pump or combination models, Davey drills are either truck or crawler tractor mounted. Rated capacities to 3,500 ft. A-2335A

Write for Bulletin E-702S

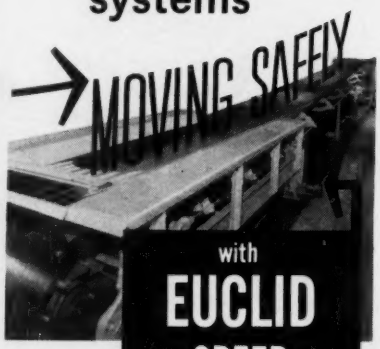
DAVEY

pioneers of "air-cooled air"

DAVEY COMPRESSOR CO.
Kent, Ohio

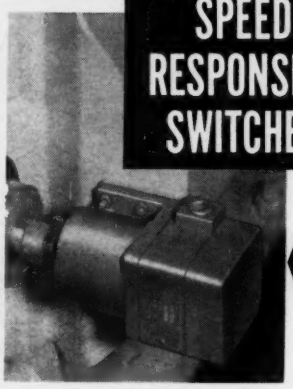


Keep conveyor systems



with

EUCLID SPEED RESPONSIVE SWITCHES



Precise speed sensing, positive control and maximum protection are assured with Euclid Type C Centrifugal Switches. Conveyor systems will not be damaged due to slipping belts, under-speeding, stalling, and material pile-ups because centrifugal force actuates the centrifugal switch contacts, making them independent of temperature and viscosity changes, eddy current variations and other atmospheric conditions. Contact your Euclid Representative for complete details. Ask for **Bulletin 2210.**

We specialize in designing the control system best suited to your individual needs. Our services are yours for the asking.

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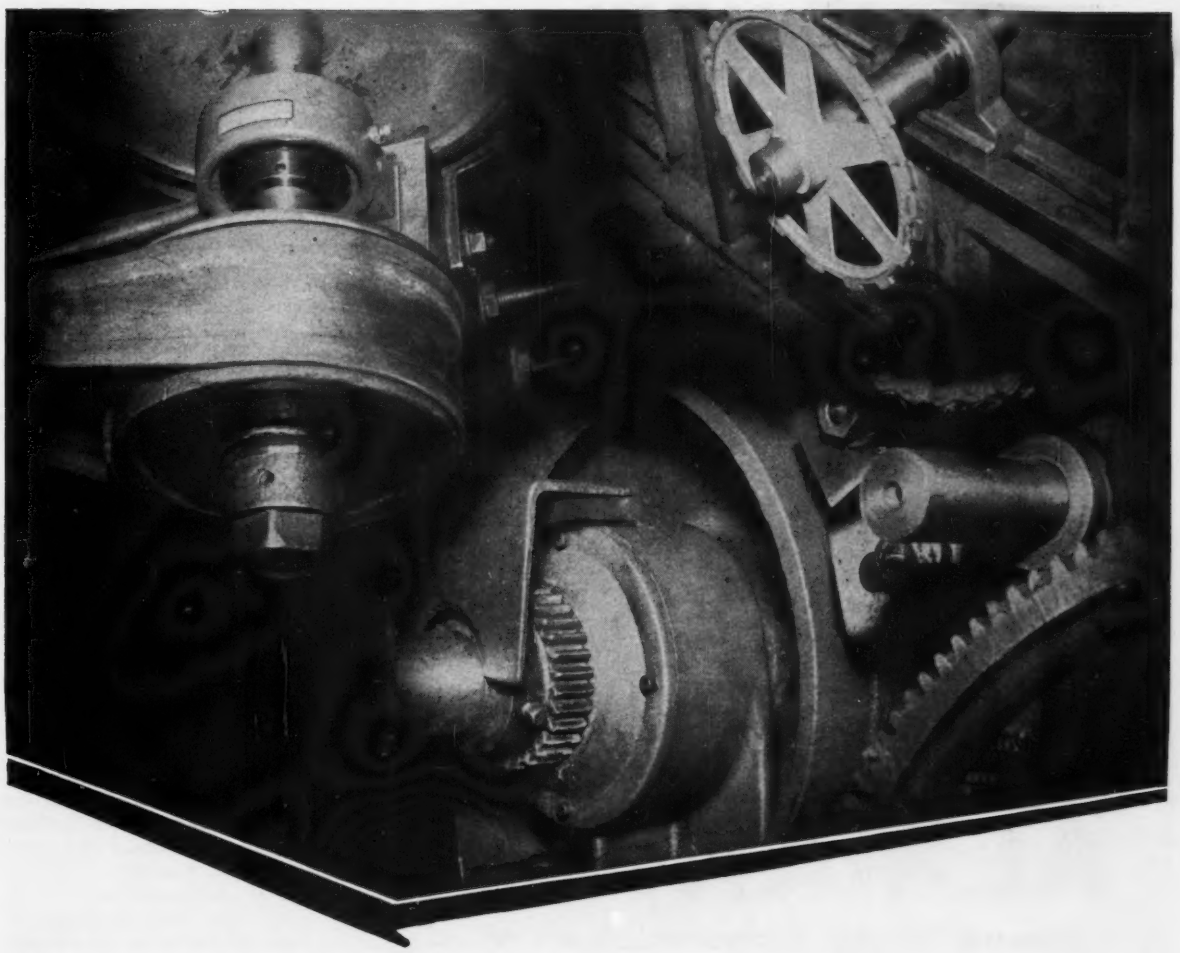
EX-31

The EUCLID Electric & Mfg. Co.
MADISON · OHIO



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NEW ABRASION RESISTANT METALS

ALMANITE®

Offers Wide Combination of Hardness and Toughness

Combining the better properties of martensitic white irons with those of austenitic manganese steel, ALMANITE is the most versatile wear resistant metal ever produced. The wide range of structures and properties available in this new group of Meehanite metals makes it possible to specify a material that provides the best combination of hardness and toughness required for different wear conditions.

There are three basic types of ALMANITE-type W for general purpose abrasion resistance; type WS for high impact and abrasion; and type WSH for severe pounding impact with abrasion. These blend into each other and modifications of all types may be specified.

ALMANITE WSH, an austenitic nodular iron possessing high strength, toughness and ability to work harden in service, was used for the 1100 pound jaw crusher casting shown above. Used to crush 8-inch rocks to 1½-inch size in one pass, test castings have worked 57 days, crushing 100 tons per hour for 8-10 hours per day without substantial wear and with no metal flow. Average life for austenitic manganese steel jaws is about 35 days.

For more information about ALMANITE, send for your free copy of the 12-page brochure illustrated. Write to: Meehanite Metal Corp., New Rochelle, N.Y.

MEEHANITE METAL

MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES.

Company Briefs

Western States Machinery Co., 2400 W. 7th Ave., Denver, Colo., has been appointed distributor of the "Michigan" line of construction and heavy bulk materials of the **Construction Machinery Div., Clark Equipment Co.** Western States' territory will cover Colorado.

In order to more aggressively pursue the development of new business and extension of industrial product lines, **B. F. Goodrich Co.** has consolidated the marketing responsibilities of various divisions into a new industrial products marketing organization. The new marketing group will be responsible for such products as conveyor and transmission belting, hose, molded and extruded rubber and plastic products, and vinyl pipe and sheeting manufactured by the firm's Industrial Products Div. Additional responsibilities transferred from other divisions include industrial footwear, automotive and industrial cellular materials.

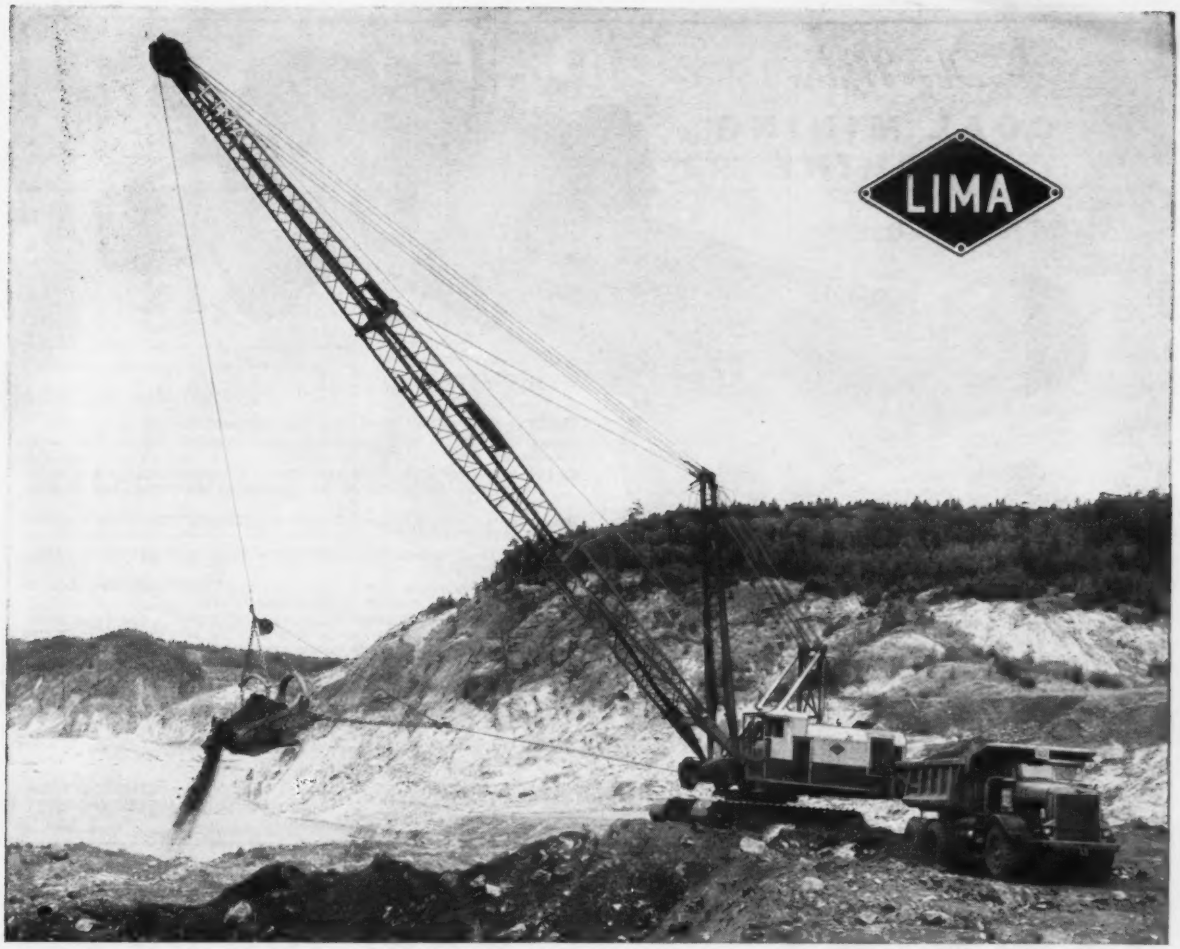
James C. Richards, formerly vice president-sales of the company's Industrial Products division, heads the new organization as vice president-marketing, industrial products.

Complete contract and sales services are now available at **Sprague & Henwood Inc.**'s new Western Regional office which opened Sept 15. Located at 2151 N. Redwood Rd., Salt Lake City, Utah, the new office will be headed by Vice President **Robert R. Carver** as regional manager. The mailing address is Box 2556.

On Oct. 1 the new Charleston District office of **Heyl & Patterson, Inc.** opened under the direction of **Jack N. Gerwig**, district sales engineer. The new office and warehouse are at 913 Brooks St., Charleston 29, W. Va.

The production of **Allis-Chalmers** engines has started in a new 515,000 sq ft engine-manufacturing facility recently completed at the company's Harvey (Ill.) Works. Operating under an automotive-type straight-line production system, material is fed into the line at one end of the building to emerge as a completely-assembled engine at the other end, ready for final test prior to shipment.

Southland Tractors, Inc. has been named distributor by **Koehring Div. of Koehring Co.** for western Tennessee, eastern Arkansas and northwestern Mississippi. The new distributor, located at 105 S. Parkway W., Memphis 9, Tenn., will sell and service Koehring's complete line of crawler and rubber-tire-mounted crane-excavators, and concrete pavers. Howard Sullins is president of Southland Tractors and Wayne Butrum is sales manager.



Lima Type 2400 dragline speeds stripping operations.

Limas dig, strip or load more . . . for less cost!

It takes a rugged breed of men and machines to mine the coal deposited so willfully around the globe by nature. Limas are part of that special breed. For wherever mining jobs call for more digging, stripping and loading capacity . . . at less cost . . . you will find Limas doing more than their share of the work.

Muscled for big jobs

The Lima Type 2400 is muscled for the really big mining jobs—as a variable capacity dragline, 8 cu. yd. shovel, or 110-ton crane. It is mounted on wide and long crawlers for extra ground contact and easy handling. Large-diameter drums are extra wide for increased cable capacity.

Anti-friction bearings reduce wear at all important bearing points. Large air-operated clutches give instant response to controls. Torque converter increases output, reduces shock loading, prevents engine stall, gives cables longer life, and lowers maintenance.

Lima quality pays

These are only a few of the many quality features that pay off for you with a Lima. As hundreds of mining operators have found, Lima's extra engineering features and built-in quality mean greater tonnage and higher profit.

There is a Lima type and size for every mining operation! Shovels ¾ to 8 cu. yds., variable capacity draglines, cranes to 140 tons. Get full information today from your nearest Lima distributor on powered-for-profit Limas—or write to us.

Lima Type 1250 High Lift Shovel stripping overburden at a West Virginia mine site.

DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD

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The Miller

COAL MINING MACHINE

SPECIFICATIONS

Motor—3 H. P. or 5 H. P. totally enclosed, fan cooled. Alternating or direct current.
Switch—Motor starter with thermal overload protection.
Drive—Silent roller chain.
Wheels—Pneumatic tires with steel rims for quick replacement.
Gear Case—Heavy rolled steel, oil tight.
Gears—Alloy steel, heat treated.
Shafts—Alloy steel, heat treated for maximum strength. Timken bearings.
Transmission—Silent type, constantly meshed gears running in oil. Clutch for easy silent shifting. Two speeds forward, one speed reverse.
Clutches—Steel multiple bevel jaws. No adjustment required.
Augers*—High grade round center wing steel, 4′ and 6′ long. Six right hand, five left hand.
Cutting Bits—Drop forged alloy steel. Jaws 3¼″ spread, fitted with tungsten carbide tips. Shanks splined for replacement and timing, held in place with set screws.
Safety Shield—Detachable front carriage with safety shield to cover bits when not cutting coal.
Shearing Pins—All augers fitted with shearing pins to prevent breaking augers, shafts and gears.
Dimensions—Approximate overall width 40″, height 19″, length 84″, width of cut 25″; with 6′ machine length is approx. 111″.
Equipment—Standard equipment includes 3 H. P. 230-volt single phase motor, 230-volt lamp, 50′ No. 8 two-conductor with No. 11 ground rubber covered mining machine cable, with fusible connectors, two sets tungsten carbide tipped bits, scraper shovel, tool box, pin punch, bit wrench, hammer, pliers, grease gun, screw wrenches, extra shear pins, chain links, etc. Extra length cable can be furnished at additional cost.

All Material and Workmanship Guaranteed

* Six Foot Augers Used With The Five Horsepower Motor

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- **Safety Speed Trigger**

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HI-SPEED TIMBER JACKS

Bevel Gears (cover not shown) and Crank. Twice as Fast as Lever Nut Type.

No. 642
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300 Tons 2"-6"

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SCALES (20 Ton)

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2—14BU-7RBE Joys, 250 V. D.C.
2—14BU-7BE Joys, 250 V. D.C.
3—14BU-3PE Joys, 250 V. D.C.
8—14BU-2E Joys, 250 V. D.C., 28″ O.H.
2—12BU-9E Joys, 250 V. D.C., Rebuilt
3—20BU Joys, 250 V. D.C., Permissible
6—Long Pig Loaders , 50 V. D.C.
1—24BB Clarkson, 250 V. D.C.
1—Eimco 21 Rock Loader, 220/440 V. A.C., 36″ t.g.

SHUTTLE CARS

5—60E-10 Joys, w/Elevators, matched pairs, 250 V. D.C.
9—42E Joys, 250 V. D.C.
5—5SC Joys, w/Elevators, 250 V. D.C.
17—6SC Joys, matched pairs, 250 V. D.C.
6—8SC Joys, Elevating Discharge, Permissible Plates, Excellent condition, 250 V. D.C.
12—32E-10 & 32E-16 Joys, Excellent condition, 250 V. D.C.
3—32D Joys, complete w/batteries
2—MT66-A45 Jeffreys, 250 V. D.C., matched pair, permissible, Excellent condition

CONTINUOUS MINERS

1—3JCM Joy, 250 V. D.C., Excellent condition

BELT CONVEYORS

1—36″ Joy Model "C" Belt Conveyor, 1,080′ centers
5—MTB 30 Joy Tandem Belt Conveyors, 1,000′ centers
4,280′—30″ 99-5GT Goodman Belt Conveyor Structure
2—99-5GT Goodman Belt Conveyor Tandem Drives
1—30″ Shop constructed Belt Conveyor Drive
7,054′—26″ Joy Model "C" Structure
9—26″ Belt Conveyor Drives, various makes
1—26″ MTB Joy Tandem Belt Conveyor, 1,000′ centers
3,000′—26″ Jeffrey 52B Belt Conveyor Structure
2—26″ Jeffrey 52B Belt Lines, complete, 1,000′ centers

PREPARATION EQUIPMENT

1—4 Cell Jeffrey Baum Jig Washer, complete, 300 t.p.h. capacity
1—Simon Carver Heavy Duty 2 compartment Baum Jig, 400 t.p.h. capacity
1—Daniels Heavy Media Washer
1—48″ CMI Centrifugal Dryer
1—36″ x 130′ Hot Material Handling Belt, Excellent
4—7′ x 15′ Single Deck Diester Tables
1—36″ x 33″ Marion Double Roll Crusher
1—30″ x 45″ Jeffrey Single Roll Crusher
1—30″ x 36″ Jeffrey Double Roll Crusher, Like New
1—30″ x 30″ Link Belt Double Roll Crusher
1—24″ x 50″ Pa. Single Roll Crusher
3—24″ x 24″ Jeffrey Single Roll Crusher
1—2′ x 4′ Williams Pulverizer
1—18″ x 24″ McClanahan & Stone Single Roll Crusher
1—18″ x 22″ Grundler Heavy Duty Hammermill Crusher & Pulverizer
1—5′ x 12′ Allis Chalmers Triple Deck Low Head Vibrator
1—5′ x 12′ Tyrex 800 Ripl-Flo Double Deck Vibrator
1—4′ x 12′ Hewitt Robbins Vibrex Screen, Triple Deck
5—4′ x 7′ Jeffrey Traylor Double Deck Vibrators
1—4′ x 7′ Jeffrey Traylor Single Deck Vibrator
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1—Set Jeffrey Dewatering Screens
4—Scraper Conveyors of various sizes
15—Drag Conveyors of various sizes
1—970′ Jeffrey Rope & Button Conveyor
9—Boom Hoists from 1 ton to 5 ton
We can construct loading booms and tipple belts in any size.

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1—WL-82 Joy Compressor, 125 cu. ft.
2—T2-6 Joy Machine Trucks
3—T2-5AE Joy Machine Trucks
4—T2-2 Joy Machine Trucks
2—T1-4G Joy Machine Trucks, 220 V. A.C.
1—Lot 9J, 10J, 23J and 24J Motors

CUTTING MACHINES

2—12RB Joys, 250 V. D.C., Permissible, dual wheels, bugdusters, 9′ bar. Excellent condition
3—11RU Joys, 250 V. D.C., Permissible, Bugdusters, one completely rebuilt
1—70-URB Jeffrey, 250 V. D.C., Excellent condition
1—29U Jeffrey, 220/440 V. A.C., completely rebuilt
10—512 Goodmans, 250 V. D.C., Hydraulically or Manually controlled
1—824 Goodman Slabber, 250 V. D.C.
30—35B and 35BB Jeffreys, A.C. and D.C.
2—7AU Sullivans, 250 V. D.C.
6—7B Sullivans, 250 V. D.C.
12—11B Sullivans, 35 & 50 h.p., 250 V. D.C.
12—12AB, 12AA and 112AA Goodmans, 250 V. D.C.
5—212AA Baby Goodmans, 50 V. D.C.
1—712CJ Goodman, 250 V. D.C.

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1—Westinghouse A.C. Sub Station, 4500 KVA 6900/2300, complete w/boards, Excellent
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5—200KW M. G. Sets
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2—150KW G. E. Rotary Converters, w/Transformers
1—150KW Westinghouse Rotary Converter, Completely Automatic
18—150KW M. G. Sets of various makes & voltages
2—100KW M. G. Sets
1—100KW Westinghouse Generator, 250 V. D.C., connected to Buda Diesel Engine, complete w/boards
2—100KW Generators, w/671 G. M. Diesel
1—90KW Generator, w/671 G. M. Diesel, Excellent
1—85KW Generator, w/75 h.p. G. M. Diesel w/ITE Automatic Control Board
1—50KW M. G. Set, 125 V. D.C., 1200 rpm
2—Armatures for 200KW Rotary G. E., type HCC
2—600 & 800 Auto Transformers
165—Transformers from 1½KVA to 800KVA, list sent upon request.

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20″ Joy Chain Conveyors, A.C. & D.C., Permissible
15″ Chain Conveyor Drives, A.C. & D.C., Permissible
15″ Long Chain Conveyors, A.C. & D.C.
12″ & 15″ Jeffrey Chain Conveyors
12″ Goodman Chain Conveyors
PT12 Long Piggyback Conveyors
PT12-B Long Piggyback Conveyors
Goodman G12½, G15 & G20 Shaker Conveyor Drives
Joy Ladel UN17 Shaker Conveyor Drives
Goodman Power Duckbills & Duckbill Hoists

LOCOMOTIVES

3—20 Ton Jeffrey MH77's, 42″ & 48″ t.g.
1—15 Ton HM828 G. E., 90 h.p. units, 44″ O.H., 48″ t.g., Excellent
10—13 Tons, 250 V., any gauge
1—12 Ton 29B Goodman, 40″ O.H.
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16—8 Tons, 250 V., any gauge
24—6 Tons, any guage
5—6 Ton Jeffrey MH150's
12—6 Ton MH88 Jeffreys
11—5 Tons, 250 V.
15—4 Tons, 250 V., any gauge

BATTERY LOCOMOTIVES

5—7 Ton Atlas
2—6 Ton Mancha, 36″ t.g., 47″ O.H.
1—4 Ton G. E., 48″ t.g.
1—4 Ton Mancha, 48″ t.g.
1—Set Gould Locomotive Batteries, 48 cell

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27—36″ t.g., Drop Bottom
150—42″ t.g. End Dump, various makes
229—42″ t.g., S. D., Drop Bottom
22—42″ t.g., A.C.F., Drop Bottom
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275—48″ t.g., A.C.F., Drop Bottom
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8,374′—2/0 Solid Copper Highline Wire
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Several thousand feet #2, #3 and #4 approved machine cable.

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1—Canton Track Cleaner, Excellent
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25—Air Compressors of various sizes
57—Auto Starters from 3 h.p. to 100 h.p.
60—Hoists from 1½ to 800 h.p.
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6—Hydraulic Schroeder Coal Drills
60—Coal Drills, various makes and sizes
91—Pumps from ¾″ to 4500 GPM
1—14″ Centrifugal Slurry Pump
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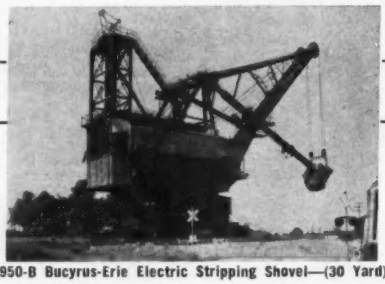

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1—35L Jeffrey Cutting Machine
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3—7B Sullivan Cutting Machines
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1—T2-5APE Joy Machine Truck
1—112G-3 Goodman Cutting Machine.

LOADING MACHINES, 250 Volts DC
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6—12BU-9E Joy Loaders
10—11BU-10APE Joy Loaders, completely modern.
4—8BU Joy Loaders
3—7BU Joy Loaders
1—18HR Joy Loader
3—360 Goodman Loaders

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2—6SC-7E Joy Shuttle Cars, modern.
1—6SC-5E Joy Shuttle Car, modern.
2—42E-18 Joy Shuttle Cars, completely modern.
1—32E-7 Joy Shuttle Car.
2—10SC-1F Joy Shuttle Cars, 500 Volt DC.
3—Model 48 TorKar Shuttle Cars.

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6—10RU Joy Cutting Machines—excellent
1—512 EJH & EJ Goodman Cutting Machines.
2—29UC Jeffrey Universal Cutters.
2—29LC Jeffrey Top Cutters.
5—35B Jeffrey Cutters.
6—35BB Jeffrey Cutters.
5—35L Jeffrey Cutters.
1—7AU Sullivan Cutter.

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1—400 KW American Selenium Rectifier

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1—G.E. 200 KW MG Set, primary 2300/4160, 1200 RPM
1—200 KW Westinghouse MG Set, primary 2300/4160, 1200 RPM
1—150 KW Westinghouse MG Set, primary 2300/4160, 1200 RPM
1—150 KW G.E. MG Set, primary 2300/4160, 1200 RPM
1—300 KW Westinghouse MG Set, primary 2300/4160, 1200 RPM
3—50 KW G.E. MG Sets, primary 2300/4160, 1200 RPM

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1—100 KW Superior Diesel Gen. Set, 275 V. DC
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ROTARY CONVERTERS, 275 Volts DC, Primary 2300/4000
1—300 KW Westinghouse, Pedestal Type
1—100 KW G.E. HCC-6, 1200 RPM, Pedestal Type
1—200 KW. G.E. HCC-6, 1200 RPM, Pedestal Type

BELT CONVEYORS
1—36" Barber Greene Lattice Frame Conveyor, 80' long.
1—MTB-30 Joy Conveyor Line Complete, 1500 ft. long, equipped with tandem drive 25 or 40 HP, AC or DC Motor.
1000'—26"—97C Goodman Belt Conveyor, complete.
2—MTB-30 Joy Belt Head & Tails, only.
1000' Joy MTB-26 Conveyor, complete—excellent.
4—MTB—26" Joy Heads and Tails, complete.

CHAIN CONVEYORS
1—350' LaDel Conveyor Line, complete
2—61AM Jeffery Conveyors—300' long.
1—61HG Jeffrey Chain Conveyor, 40' long.
1—Jeffrey 300'—15" Chain Conveyor.

LOCOMOTIVES
1—G.E. 6 Ton Locomotive w/Reel, 36" gauge.
1—1030 Goodman Locomotive, 24" high, 44 " gauge.
1—13 Ton Goodman—Type 81A04T, Modern.
1—Goodman 13 Ton 136B-0-4-B w/75 HP Motors.
2—13 Ton Jeffrey Locomotives
1—Goodman 5 Ton 3012 with 50 HP Motor.
4—8 Ton 132AK42-48R Goodman w/2—50 HP Motors.
1—8 ton 32-0-4-T Goodman with 2—50 HP Motors.
1—8 ton LM2-8-T.DD G.E. with 2—50 HP Motors.
3—6 ton LM2-T-6MM G.E. with 2—35 HP Motors.
2—6 ton LM2-4-6-11 G.E. with 2—35 HP.
3—Greensburg Monitors complete charging equipment.

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1—American Pulverizer 24"x24", 30 tph—#WC-24
1—American Pulverizer 24"x30", 75 tph—#WC-30
1—American Pulverizer 36"x30", 100 tph—#AC-30-S.

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19—Sanford Day 3 Door Drop Bottom Cars, 36" high.
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173—AC&F Drop Bottom Cars, 48" high, new condition.
5—Mantrip Cars.

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1—Coppus Ventair Blower.
5—8x16 Allis Chalmers Pumps with motors.
1—16x14 Allis Chalmers Centrifugal Pump, complete.
1—Roberts & Schaefer Eleptic Vibrator.
1—Roberts & Schaefer Air Drying Plant, complete.

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1—Shovel Dipper Stock for same, 16' long, ¾ yard dipper.
1—1950 International Flat Bed Tandem Truck.
1—Allis Chalmers Tractor Hi-Left.
1—Caterpillar Tractor D-6, 60" Guage.

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2—T2-5APE Joy Machine Trucks.

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10—Chicago Pneumatic Little Giant Coal Drills, 220 Volts AC.
2—CD-22 Joy Coal Drills, 250 Volts DC.
5—Dooley Self-Propelled Drill Trucks, twin-armed, track or rubber.

ROOF BOLTING MACHINES

HOISTS
10—Vulcan-Denver #11½ Material Hoists w/-motors.
1—Brownie Hoists, 5 HP, AC
1—Brownie Hoist, HKO, good condition.
1—Joy CHD, 10 H.P. Hoist, 250 Volt D.C.

COMPRESSORS
2—Acme Self-Propelled Air Compressors, Model 168.

ROCK DUSTERS
2—Manson 24-S Wet Rock Dusters.
2—MSA Rock Dusters, 25 H.P. Track
2—MSA Bantam Rock Dusters, rubber tired.
1—American Mine Door Rock Duster, 22" high.

FANS
1—Jeffrey 8H-42 Aerodyne Fan complete w/motor, "V" belt & tubing.
1—Jeffrey 8H-60 Aerodyne Fan complete w/G.E. 100 H.P., 440 V. AC Motor & Auxiliary Ford Industrial Power Unit.

CONTINUOUS MINERS
2—1CM Joy Continuous Miners, 250 Volts DC.
1—Goodman Continuous Boring Machine, 440 Volts AC, 250 HP, can be converted to twin borer.
1—5JCM Joy Continuous Miner with self-tramming and extensible belt, 440 Volt AC complete with 1000 ft. of structure and belting.

MISCELLANEOUS
20—40 lb. Switches, complete.
20—60 lb. Switches, complete.
1—American Mine Door Automatic Electric Throw Switch.
1—75 HP Starter for AC Wound Rotor Motor, drum type complete with resistance.
3—2300/4160 Y—230-115 Volt—200 KVA G. E. Transformers.
3—2300/115/230 Volt—15 KVA G.E. Transformers,
1—4x10 Double Deck Vibrating Screen.
1—Nolan Portafeeder, complete.
1—Canton Track Cleaner, 42" gauge.
1—5" Pomana Deepwell Pump
1—Manson Mine Jeep, 40" gauge.
1—CY-21 Reel and Motor, complete.
2—Lincoln 300 amp. MG type DC Welders
2—Hobart 300 amp. MG Type DC Welders
4—Guyan Resistance Bonder Welders.
495 ft.—1/9 Conductor 5000 Volt Rubber Covered Cable w/ground.
2000 ft.—2/0-3 Conductor 2300 Volt Rubber Covered Bore Hole Cable.
3000 ft.—4/0-3 Conductor 5000 Volt Trench Cable.
4000 ft.—2/0-3 Conductor 5000 Volt Trench Cable.
AC and DC motors ranging from 1 to 100 H.P.
Complete inventory of new parts for 10SC, 10RU and 11BU Joy Equipment. Hundreds of other items such as pumps, motors, armatures, locomotive trucks, wheel units, hydraulic pumps, conveyor chain, cat chains, tipple draglines, etc., too numberous to list.

ALL EQUIPMENT LISTED AND HUNDREDS OF OTHER ITEMS ARE IN STOCK AND MAY BE INSPECTED AT OUR SHOP AND EQUIPMENT YARDS LOCATED AT RALEIGH, WEST VIRGINIA AND O'FALLON, ILL.

MOUNTAIN STATE EQUIPMENT COMPANY

Beckley, West Virginia, P. O. Box 1050, Phone CL 3-7383

J. J. Mahoney, Res. CL 3-6804 • W. R. Monk, Res. CL 3-6907

R. E. Kamm, Summersville, Res. 4281

O'Fallon, Illinois, P. O. Box 150, Phone ME 2-3621

Roy Fairchild, Res. ME 2-5881

J. J. Mahoney

PROFIT SHARING FOR EVERYBODY!

We share our profits with those from whom we buy and to whom we sell, by passing on the savings of large-scale, diversified operation. That's why we pay year-round fair prices for any kind and quantity of mining equipment and/or complete mines. That's why we guarantee mine operator's who buy from us an unfailing source of supply at fair prices always! Choose from our Huge Stock of the Best in latest type Mining Equipment. Six Mines now being dismantled in various sections of the country. Send us your Inquiries. Known by the Reliability of our Service as well as the Quality of our Product. We Buy—Sell—Trade.

JOY EQUIPMENT—REBUILT

2—Joy 14BU 9AE Super Loaders—26″ Hi—New 1958.
2—Joy 14BU Loaders, low pedestal, 7AE, 1956 & 57.
4—Joy 14BU Loaders, medium pedestal, 7RBE.
2—Joy 14BU 7CE high pedestal loaders.
4—Joy 14BU 3PE Loaders.
2—Joy 12BU Loaders complete with Piggybacks.
2—Joy 12BU Loaders, 9E, latest type, 250 V. DC.
3—Joy 12BU Loaders, 220/440 Volt AC.
1—Joy 20BU Loader, latest type.
4—Joy 11BU Loaders, latest type.
1—Joy 8BU Loader, 34″ overall height.
1—Joy 8BU Loader, 220 V. AC.
1—Joy curved Bar Head for 14BU, complete.
6—Reliance 24-J Motors, 7½ H.P.
4—Reliance 38-J Motors, 10 H.P.
2—Reliance 40-J Motors, 15 H.P.
20—Reliance 9-J Motors, 4 H.P.
1—Goodman 660 Loader on Crawlers, excellent 250 V. DC.
1—Goodman 665 Loader on Crawlers, latest type 250 V. DC.
1—Goodman 865 Loader, 26″ hi. 250 V. DC.
4—Joy 8SC Shuttle Cars, 26″ hi., rebuilt.
5—8SC Shuttle Cars, as removed from service. 26″ hi.
4—Joy 6SC Shuttle Cars, rebuilt, latest type.
6—Joy 6SC Shuttle Cars, as removed from service.
1—Joy 5SC Shuttle Car. Excellent.
2—Joy 32E9 Shuttle Cars.
2—Joy 32E10 Shuttle Cars, rebuilt.
6—Joy 32E15 Shuttle Cars, rebuilt.
4—Joy 32E16 Shuttle Cars, rebuilt.
10—Joy 42E16 Shuttle Cars, rebuilt and as is.
1—Joy CD-22 Drill, on rubber, like new.
6—Joy T-2-5 low pan Crawler Trucks, rebuilt.
1—Joy T-2-6 low pan Crawler Truck with reel.
2—Joy T-1 Standard Crawler Trucks, 220 AC.
1—Joy T-1 Standard Crawler Truck, 250 DC.
4—Joy 11-B Cutting Mach., like new, 35 & 50 H.P.
4—Joy 7-B Cutting Mach., like new, 250 & 500 V.
4—Goodman 212 Cutting Machines, 19″ high.
2—Goodman 312 Cutting Machines, 17″ high.
2—Goodman 412 Cutting Machines, 19″ high.
1—Goodman Machine on Crawler, 31″ high. All hydraulic.
6—Goodman 512 Machines with Bugdusters. Rebuilt and as removed from service.
6—Goodman 612 Cutting Machines, 250 and 500 volt.
1—Jeffrey 70 URB rubber tired Cutter, Universal head, perfect condition.
1—Joy 11RU Rubber Tired Cutter with Bugduster, Universal head, dual tires, like new, 250 V. DC.
1—Joy 10RU Rubber Tired Cutters, Universal head, 250 V. D.C. Rebuilt or as is.
1—Sullivan 7AU on Dual Rubber Tires, 250 V. DC.
6—7AU's on track. Universal head.
2—Jeffrey 29UC Cutting Machines, Universal head, cuts anywhere in seam, 38″ high, on Crawlers, 250 volt D.C.
4—Jeffrey 29LC on Crawlers, rebuilt or as removed from service.

LOCOMOTIVES

1—Goodman 6 ton, 93-A, 27″ hi, armor plate frame.
1—Jeffrey 15 ton MH-77 Locomotive, armor plate frame.
7—Jeffrey, 13 ton, Type MH-110, 36″, 42″, 44″ ga.
2—Jeffrey, 10 ton, type MH-110, 42″ and 44″ ga.
2—Jeffrey, 10 ton, type MH-78, 42″ and 44″ ga.
2—Goodman 8-30 and 10-30 Locos., 26″ above rail.
1—Jeffrey MH-150, 6 ton, 26″ overall height, rebuilt with reel.
12—Jeffrey, 6 ton, type MH-88, 42″, 44″ and 48″ ga.
4—Jeffrey, 8 ton, type MH-100 2½″ armor plate frames.
3—Jeffrey, 4 ton, type MH-96, 42″, 44″, 48″ ga.
1—G.E., 4 ton, type 825 Locomotive, 22″ high.
10—G.E., 6 ton, types 801, 803, 821 Locomotives, 42″, 44″ and 48″ ga.
1—G.E., 8 ton, type 822 Locomotive, 44″ ga.
3—G.E., 10 ton, type 809 Loco., 42″, 44″, 48″ ga.
2—G.E., 13 ton, type 829 Loco., armor plate frames.
1—Goodman 91A Loco., 8 ton, 26″ overall ht.
2—Goodman, type 33, 6 ton, 44″ and 48″ ga.
3—Westinghouse, type 902, 4 ton, 42″ and 48″ ga.
1—Atlas Battery Locomotive 36″ ga.
1—Atlas Trolley Locomotive, 4 ton, 24″ high.
2—Westinghouse, type 904, 6 ton, 44″ and 48″ ga.
2—Westinghouse, type 906, 44″ and 48″ ga.
2—Westinghouse, type 907, 10 ton, 44″ & 48″ ga.
3—Westinghouse 908, 13 ton, Loco., 42″ & 48″ ga.
8—Jeffrey MH-78 Locomotive Units, cheap.
4—Jeffrey MH-88 Locomotive Units, real bargains.
6—Jeffrey MH-100 Locomotive Units, reasonable.
3—Plymouth Diesel Locomotives, 8 and 10 tons, 42″ and 44″ ga.
Locomotive Trucks & Spare Armatures for the above.

TIPPLE EQUIPMENT

1—All Steel 5 Track Tipple, new 1957, complete with washer, silo, oil treating system, all bolted construction.
1—Complete Five Track Tipple with Washers and Air Tables.
1—Complete stoker plant, all steel.
2—Complete tipples, 3 & 5 track, steel and wood.
3—Cleaning Plants, 1 Ea. McNally, Roberts and Schaefer, Jeffrey, Washers and Air-Flo Tables.
4—Complete Aerial Trams for coal or refuse.
3—Complete Rope and Button Lines.
2—Monitor Lines complete with Drums, excellent.
1—Allis-Chalmers 5′ x 12′ Rippflo Vibrator.
1—Allis-Chalmers 4′ x 12′ Low-Head Vibrator.
1—Robins Gyrex Vibrator, 4 x 10.
10—Belt and Apron type Loading Booms.
6—Shaker Screens.
1—Robins Car Shakeout.
1—Gundlach Crusher, like new.
20—Crushers, various sizes—Jeffrey, Link-Belt, McLanahan & McNally.
4—Mine Scales, 10 & 20 ton.
5—Truck Scales, 25 to 40 ton, New & Used.
Feeders, Belt and Drag Conveyors, Car Retarders.

CUTTING MACHINES

1—Joy 10RU Rubber Tired Cutters, Universal head, 250 V. D.C. As is or rebuilt.
1—Joy 11RU Rubber Tired Cutter, 250 V. D.C.
2—Jeffrey 29UC Universal Machines on Crawlers.
1—Goodman on Crawlers, 31″ overall height.
4—Baby Goodman 212's, rebuilt, 250 V. D.C.
2—Goodman 312 Cutting Machines, 17″ high.
3—Goodman 412 Cutting Machines, 19″ high.
6—Goodman 512's, with Bugdusters, like new.
4—Goodman 512's, rebuilt, or as removed from service.
6—Goodman 612's—250 & 500 Volt.
3—Goodman 112's, 220/440 V. A.C.
4—Joy 7-B Cutting Machines, 250 and 500 Volt.
4—Joy 11B Cutting Machines, rebuilt, 35 & 50 H.P.
6—7AU's, on track, Universal Head.
10—Goodman 12AA's and 112AA's, 250 V. D.C.
2—Goodman 324 Slabbers.
2—Goodman 724 Slabbers.
2—Goodman 824 Slabbers.
6—Jeffrey 35L's, like new, 250 V. D.C., 17″ high.
2—Jeffrey 35L's, on low vein trucks.
3—Jeffrey 35BB's, 220/440 A.C.
15—Jeffrey 35B's and 35BB's 250 V. D.C.
2—Jeffrey 29B's on track.
10—Jeffrey 29C's, track mounted.
2—Jeffrey 29L's, on Crawlers. Excellent.
4—Sullivan CE7, 220/440 V. A.C.

CONVEYORS

2—Joy 1200′ Belt Conveyors, 30″. "Limberroller," like new.
1—Each 30″ and 36″ Joy 1000′ extensible belt, latest type, like new.
1—Goodman 97HC 30″ Rope Belts, 1000′ perfect. With or without rubber.
4—Jeffrey 52-B tandem drive 30″ and 36″ Belt Conveyors, 600′ to 2000′.
1—Jeffrey 52-B tandem drive 26″ Belt Conveyor.
1—Joy 30″ Underground Belt Conveyor, Excellent.
1—Goodman 97-C, 30″ tandem drive.
1—Robins 36″ tandem drive, with or without motor.
2,000′ 52-B Belt Structure, 30″.
1,000′ Conveyor Belt, 42″.
1,500′ Conveyor Belt, 36″.
2,000′ Conveyor Belt, 30″.
1,000′ Conveyor Belt, 26″.
8—Jeffrey 61AM 12″ Chain Conveyor, 300′.
2—61EW Elevating Conveyors.
2—61WH 15″ Room Conveyors, 300′.
2—Joy 15″ Room Conveyors, 300′.
2—Joy 20″ Conveyors, 300′.
4—Joy Ladel UN-17 Shakers.
10—Goodman G-12½ and G-15 Shakers.
1,000′ Goodman 18″ Flat Belt Conveyors, tandem drive any length. Perfect.

CONVERTERS AND DIESEL PLANTS

1—300KW G. E. Stationary Rectifier.
2—500KW G.E. Stationary Rectifiers.
4—1,000KW Stationary Rectifiers.
2—100KW, G.E. TCC-6's, 275 V., Rotary Converters.
1—150KW, G.E. HHC-6, 275 V., Rotary Converter.
1—150KW, 6 phase, Allis-Chalmers Rotary Converter, 275 V. D.C.
2—200KW G.E. HCC-6's, Rotary Converters, 275 V. D.C. Steel frames. Newly rewound.
3—300KW G.E. HCC-6's, Rotary Converters, 275 V. D.C. Like New.
2—300KW Westinghouse, 6 phase, Rotary Converters, 275 V. D.C.
2—500 KW West. Rotary Converters, 275 V. D.C.
1—200KW Westinghouse Rotary Converters, 275 V. D.C. Newly rewound.
(All the above with 6900/13000 and/or 2300/-4000 primary transformers)
1—50KW MG Set.
1—100KW MG Set, 275 V. D.C.
6—150KW MG Sets, G.E. and West., 275 V. D.C.
2—200KW MG Sets, West., rebuilt, 275 V. D.C.
1—200KW MG Set, G.E., perfect, 275 V. D.C.
2—300KW G.E. MG Sets, like new.
3—300KW Westinghouse MG Sets, 275 V., rebuilt.
1—300KW Westinghouse, 600 volt MG Set, rebuilt.
2—500KW G.E. 275 volt MG Sets, 2300-4000 V. primary rebuilt.
2—200KW G.E. Rotary Converters, 600 V. D.C.
2—300KW West., 600 volt, 6 phase, Rotary Conv.
4—300KW G.E. Rotary Converters, 600 V. D.C.
1—500KW G.E. Rotary Converter, 275 V. D.C., 6 ph.
1—500KW Westinghouse, 275 V, 6 ph. Rotary Converter.
2—500KW Westinghouse, 600 volt, D.C., 6 phase, Rotary Converters.
2—500KW G.E., HCC-6's, Rotary Conv., 6 phase, 600 V. D.C.
1—GMC-671 Diesels w/75KW, 250 V. D.C.
1—Cat. 318 Diesel with 75KW Generator.
1—Int. UD-14 Diesel with 50KW, 250 V. D.C. Gen.
1—GMC-471 Diesel with 60KW, 250 V. D.C. Gen.
1—100KW Natural or LP Gas Engine with Generator.

LOADING MACHINES

16—Joy Loaders, 14BU, 12BU, 8BU, 11BU, 20BU.
5—Joy 12BU9E Loaders, 220/440 V. A.C. Excellent.
3—Joy 12BU9E Loaders, latest type.
2—Joy 12BU with Piggyback Conveyors.
1—Goodman 865 Loader, 26″, on Crawlers.
1—Goodman 665 Loader, on Crawlers, rebuilt.
1—Goodman 660 Loader, on Crawlers, 250 V. D.C.
1—Goodman 460, on track, rebuilt, all hydraulic.
2—Jeffrey 61 CLR's on rubber, 26″.
3—Jeffrey L-500 Loaders.
2—Myers Whaley, No. 3 Automatic Loaders.
2—Clarkson Loaders, 26″ above rail.

MISCELLANEOUS

1—Jeffrey 76-A CoilMel, 220/440, perfect.
1—Joy 5 JCM Continuous Miner, 220/440, perfect.
150 Tons Copper 4/8 and 9 Section Trolley 1/0, 2/0 4/0 Stranded. 500 MCM, 750 MCM—1,000,000 MCM Insulated.
1 Each 4′-5′ 6′ & 8′ Hi Pressure Joy & Jeffrey latest type fans.
1—Complete Five Track Tipple with Washers and Air Tables.
5—Complete Tipples, 3 to 5 Track. Wood and Steel.
Steel Trestles for drop bottom cars.
All Steel Armco Buildings.
20—Jeffrey Melveyors on rubber tires.
1—¾ Yard Shovel and Back-Hoe.
2—¾ Yard Crawler Cranes. Gas.
Battery Supply Tractors, Rubber Tired.
1—Cantrell Air Compressor on rubber tires.
10—Air Compressors, 1 H.P. to 40 H.P.
1—Joy self-propelled rubber tired comp., 240 cu. ft.
1—Acme self-propelled rubber tired compressor, 130 cu. ft.
40—Mine Pumps, all types.
1—Differential 40 Passenger Man-Trip Car.
6—MSA Rock Dusters.
Joy Roof Drills—Schroeder Coal Drills.
2—Phillips Carriers, 44″ and 48″ ga.
1—Barber-Greene self-propelled Bucket Elevator.
Pipe, Plastic, Steel, Transit, all sizes 1″ to 6″.
25,000 Roof Bolts, all types.
300—Mine Cars, drop bottom, 42″, 44″, 48″, ga.
300—Mine Cars, 18″ hi., end dump, 42″, 44″, 48″ ga.
1—10 ton Mine Car Scale with Recorder.
4—Brown Fayro 15 HP latest type Hoists.
15—Brown Fayro HKL and HG Car Spotters.
1—Brown Fayro Hydraulic Car Spotter.
1—12 ton Differential Slate Larry.
Incline Hoists, 25 to 150 H.P.
Shaft Hoists to 700 H.P. Complete.
1—Jeffrey 5′, 6′ & 8′ Aerodyne Fans, Like New.
6—Storage Tanks, 6000, 8000, 10,000 gallons.
2000 Five Gallon G.I. Cans, screw lids.
2,500 tons Relaying Rail, 25lb., 30lb., 40lb., 50lb., 60lb., 70lb., 90lb., 100lb.
500 MCM, 750 MCM, 1000 MCM, Bare & Insulated.
Thousands of feet of rubber covered three conductor cable. All sizes.
500—Transformers from 1 to 500 KVA, 110 to 13,-000 primary volts.
400—Electric Motors, 3 to 250 H.P.
Huge Stock of Mine Supplies.
600—MSA Mine Lamps, Chargers, etc.
4—Mine Scales, 10 & 20 ton.
5—Truck Scales, 25 to 40 ton, late type.
Mack & International tandem dump trucks.
THOUSANDS OF OTHER ITEMS.

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PHONE PL 2-4400

J. T. FISH

LOGAN, WEST VA.

COAL AGE Advertisers

. . . Partners in Progress

COAL OPERATORS attribute no small share of the coal industry's achievements of the past decade to the contributions of manufacturers of mining machinery, equipment and supplies, their engineers, designers and sales organizations.

Utilizing the tremendous technological advances resulting from the cooperation between mine management and manufacturers seeking to continually develop and sell new and better equipment, the coal mining industry has by its own ingenuity and investment in modern facilities raised output per man-day 94% in the past 10 years and established itself as one of the most progressive industries in the nation..

We on COAL AGE feel that our 50th Anniversary is a most welcome opportunity to publicly commend our advertisers—the most prominent and industry-oriented manufacturers in the field—for their contributions to modern methods of coal mine operation and preparation. To the many advertisers who have joined us in the pages of this Anniversary Issue, to those who have advertised regularly over varying periods of years, and to those whose participation we expectantly anticipate in future issues, we offer our thanks for their confidence in COAL AGE as the leading source of technological information serving coal mining. As most of our subscribers realize, it is only through the income derived from our advertising pages that we can provide the comprehensive editorial service for which COAL AGE has been noted over the years.

We think, too, that coal men will join us in complimenting our advertisers for the highly useful job of industry communication they carry on through their advertising. Basically, advertising is primarily a method of mass communication, a means of presenting to thousands of readers helpful facts and useful information that with the same time and expense could be disseminated only to a few through personal contact.

Our own reader research program carried out in recent years, with which thousands of our subscribers are personally acquainted, demonstrates that practically every COAL AGE reader makes a conscious effort to review our advertising pages, purposefully looking for new ideas and useful information on the machinery and equipment he uses. According to the comments subscribers make to our researchers, you quite rightfully feel that the advertising pages complement our editorial pages most effectively. In fact, among the many reasons you give for considering COAL AGE the most useful source of information available on your job are "more advertising . . . . better advertising."

We are proud to list on the following two pages the 176 advertisers appearing in this 50th Anniversary Issue, and to call your attention to the 13 advertisers who advertised in COAL AGE 50 years ago and the 38 advertisers who participated in our 25th Anniversary Issue in October, 1936. Obviously, age is only one of many criteria. Many firms who have been active in business for only a few years are today highly important suppliers to the coal industry and offer through our pages advertising messages of major significance to the industry.

Equally important, we suggest that you can look with confidence to the firms who advertise with us. These firms are willing to present their products, their design and research facilities, the services of their sales organizations, in public print. By the mere fact that they advertise, manufacturers show that they stand behind their products and that you as a buyer or user can have full confidence in them. Their willingness to publicly display their products and back their word in the marketplace is a strong reason for meriting your continued consideration.

D. C. McGraw Jr

Publisher, COAL AGE

Advertisers Appearing in COAL

★ Manufacturers whose advertising appeared in COAL AGE during our first year of publication, 1911-1912

⊙ Manufacturers whose advertising appeared in COAL AGE's 25th Anniversary Issue, October, 1936.

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COAL AGE Advertising Sales Staff

Gordon A. Mack
Advertising Sales Manager

William H. McNeal, Research Manager

Charles T. McCullough, Assistant Market Research Manager

DISTRICT MANAGERS

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1375 Peachtree St., N.E. Telephone: 875-0523

Boston 16 ..... **R. W. Peckham**
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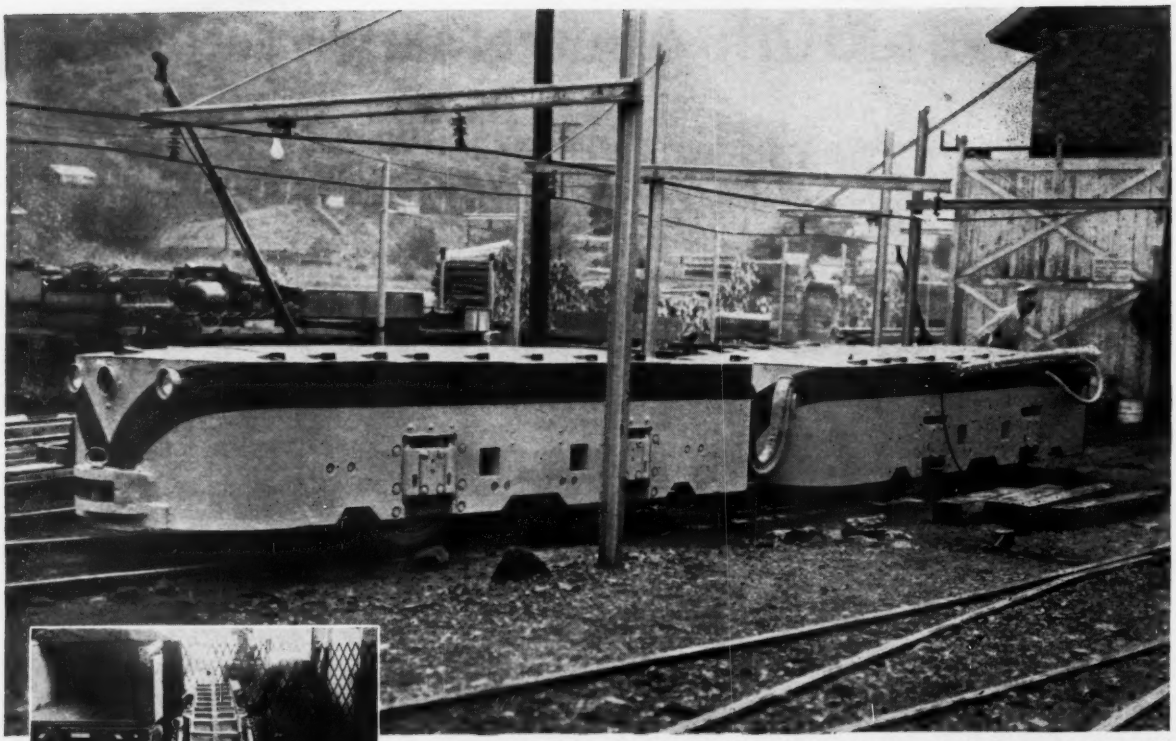
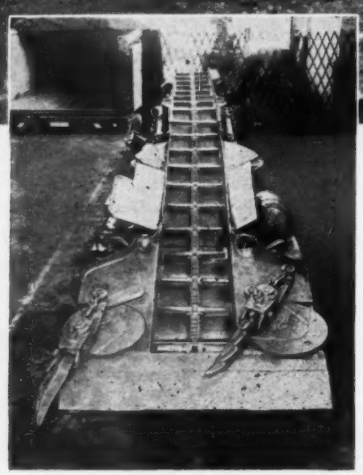
2 Place du Port, Telephone 244274/75



Back on the job. *Mine locomotive was completely rebuilt and modernized with contactor control, air brakes, air sanding and new bumpers.*



Not brand new but National new. *Rebuilt coal loader is one of many types of machines serviced by National's two coal field plants; in Bluefield, West Virginia, and Harlan, Kentucky.*

Get complete equipment rebuilding from National

The Specialists in electric coils/repair service

National offers not only electrical repairs but complete rebuilding service on all types of mining machines.

Often you'll find that National-serviced equipment performs better than new. The reason—equipment is not just restored but is modified to incorporate new developments and upgrade original performance. Motor windings, for instance, have the very latest and best grade insulation tailored by National to your requirements. The latest improvements in control and mechanical systems bring your equipment up-to-date at the time of complete overhaul.

National completely dismantles, inspects, rebuilds and tests. The work is done by specialists. For fast service, contact our nearest plant or your National field engineer.

NATIONAL COILS

National Electric Coil

COLUMBUS 16, OHIO • IN CANADA: ST. JOHNS, QUEBEC

DIVISION OF McGRAW EDISON

unemployed since 1920

In 1920 MSA sent the canary back to the parlor.

Such makeshift safety precautions had had it. That was the year MSA instruments replaced canaries for CO detection. By 1920 MSA was also supplying miners with other protective equipment then available: breathing apparatus; flame safety lamps; resuscitation devices; safety signs; first aid supplies.

These items helped a lot. But not enough to meet the demands of a progressive mining industry. The solution: manufacture *all* the products essential to a miner's protection and efficiency.

That's just what MSA did.

Today, MSA not only meets new hazards, MSA anticipates them. This requires constant research. development. improvement. The result: the most effective, economical equipment a miner can use.

When you order safety equipment, it makes sense to talk to MSA first.

(After all, MSA's the cat that got the canary.)

MSA **MINE SAFETY APPLIANCES COMPANY**
Pittsburgh 8, Pennsylvania

What makes this 3½-yd. P&H the most productive high-front shovel in the business?

This P&H, with its 48′ high-front has proved its ability to outproduce other shovels in its size range by up to 15%! *Here's why:*

Speeds cycle time. Exclusive Magnetorque Swing is unequalled for speed . . . cuts downtime and maintenance costs, too, because it employs magnetic force . . . eliminates friction-type swing clutches. With Magnetorque, there are no stops for clutch adjustment . . . no bands or linings to replace—ever!

Delivers positive, full power and has the strength to use it. The 3½-yd. P&H gives you 77,900 lbs. bail pull—more power per cu. yd. of capacity than any competitive unit. P&H Planetary Crowd and Retract uses chain for positive, long-life application of power. The massive strength required to handle this power is provided by P&H-pioneered all-welded construction, using a variety of the strongest alloy steels available.

Offers superb stability to work effectively at long range. Long crawlers provide an excellent working base. Live Roller Circle equalizes load distribution, smooths out swings, cuts maintenance and service costs.

Provides extra-strength in boom and stick. Unique boom and straddle-type stick design, proven superior in heaviest mining service, utilizes high-strength alloy steels and advanced engineering to absorb shocks and twist with ease.

Contact your P&H dealer for complete information. Or write us for literature.

HARNISCHFEGER P&H
CONSTRUCTION & MINING DIVISION
Milwaukee 46, Wisconsin